Proceedings

OF THE

Michigan Schoolmasters' Club

AT THE

Thirty-Ninth Meeting

HELD IN

YPSILANTI, March 31, April 1, 2,

1904

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INDEX

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PROCEEDINGS OF THE THIRTY-NINTH MEETING, HELD AT YPSILANTI, MARCH 31, APRIL 1, 2, 1904

PAPERS

EDITED BY THE SECRETARY

GENERAL MEETING

SOME PROBLEMS IN EDUCATION.

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Never in the history of education in America has there been such a universal movement towards change as now. Conscious that existing plans must be modified, all who are interested in education have a feeling of great unrest, and this feeling expresses itself at every educational conference. Discussions are endless, and often apparently fruitless, for opinions are as numerous as are the factors of the problem, and the mighty power of what has been over the frail form of what might be holds us with a death-like grip.

It is not probable that some great educational reformer will arise and lead us directly to the truth. In these days we are all searching for the truth so eagerly that it is not likely to come as a sudden revelation. It will probably come by a series of approximations, and it will not be recognized until it has been thoroughly tested; and when it is known and acknowledged no one can tell who has been responsible for it, for it will have been evolved gradually from all our former experience. There is no problem concerning which we can so ill afford to be dogmatic; and no one concerning which we are so dogmatically inclined. There is no question concerning which past experience may be so unsafe a guide, since what we have attained cannot be compared with what we hope for and have a right to expect. There is no problem in which theorizing may lead so far astray, and no problem which

has been so covered up with crude theorizing. We do not understand the structure we are seeking to modify and develop; we do not know what we want to do for it when we shall understand it; and we do not know how to accomplish when we shall know what we want. Out of this mass of negations we are constructing our hypotheses, and even venture to hope that they may stand. That student of education has not advanced very far into his subject who has any great measure of confidence in his own opinions, or in those of any one else. The effect of all this should be, not a discouraged, but a receptive mind; not dogmatism, but liberality. There need be no expectation that the true education is just at hand, and those impatient souls who cannot rest content until everything is settled must cultivate the scientific spirit, which has learned to labor and to wait. It is no less a fact, however, that the true education is nearer at hand than it was last year, and that its coming will be hastened in proportion to our dissatisfaction with the existing order of things, and our rejection of that mind benumbing dogma that the past contains all that is best in education. Our educational growth should be like that of a vigorous tree, rooted and grounded in all the truth that the past has revealed, but stretching out its branches and ever renewed foliage to the air and the sunshine, and taking into its life the forces of today.

With such a preface it may seem rash to suggest anything, but all of us must keep suggesting, if it is only the suggestion of a doubt. The subject announced is broad enough for me to select what I choose from the mass of educational problems that are constantly presenting themselves. If any of those which I have selected, or even all of them, do not seem pertinent to your situation, you must understand that for some reason they have forced themselves upon my attention.

The first problem I would suggest is:

1. *The act of teaching.*—This is quite independent of the subject-matter and has no reference to the equipment of the school in material things. It concerns simply the contact of teacher and pupil in the act of teaching. Perhaps the most difficult work of the teacher is to appreciate the exact mental condition of the pupil in reference to any subject. Unless there is complete adaptation in this regard the contact is a failure, leading to mutual disgust and distrust. It has been my good fortune to witness a large amount of teaching in all grades, and the impression left upon me has been one of astonishing lack of simplicity and directness in the presentation of subjects, resulting in utter confusion. My own conclusion has been that this indicates either ignorance of the subject, or lack of teaching ability, or a wooden application of some pedagogical refinement which has been learned somewhere, and which is either not worth applying in any case, or is woefully misplaced. Hardly can there be imagined a worse combination than wooden teaching by one ignorant of the subject. In a great mass of teaching, instead of using clear expression and a direct presentation, the effort seems to be to use most unusual phrases, as far from an ordinary vocabulary as possible, and to approach the subject in such a devious way that its significance is in danger of being missed. The philosophy of teaching is well enough as a background, but philosophical teaching is usually out of place. To inject

the abstractions and phrase-making of normal training into the school room is to dismiss clearness and all intellectual contact with pupils. This is no criticism of pedagogical training, for I would be the last to suggest that any profession should be attempted wihout professional training; but it is a criticism of those teachers who do not know how to apply their training, and follow what they regard to be rules, rather than principles. Probably the greatest factor in this result is the fact that far too many teachers have learned the form of teaching merely, and have strangely neglected to gain some knowledge of the subject-matter to be taught. With them it is form without substance, and what else are they equipped to do but to go slavishly through the motions of teaching? There is no flexibility, no power of adaptation, no ability to depart from a fixed routine, and hence no adjustment to the very diverse mental conditions they must meet and are expected to stimulate. Necessary flexibility in methods is impossible without a broad grasp of the subject to be presented. It should be unnecessary soberly to state that methods of presentation amount to nothing without something to present, but the schools seem to need the statement. The amount of meaningless drudgery that this senseless formalism has forced upon pupils has long been recognized by parents, whose indignation occasionally breaks out in condemnation of the schools as places where method has run to seed. It is very fortunate that the human mind is so tough a structure that it will develop in spite of teachers, and all of our educational experiments have not succeeded in sensibly stunting it. I have about concluded that the great problem in the act of teaching is not how to impart instruction, but how to oppose the fewest obstacles to mental development. The human mind has a mighty way of overcoming obstacles, but, as teacher, we have no right to attempt to make them insurmountable. I have almost cried out in indignation when witnessing some pupil whose quick mind has discovered short cuts to results, ruthlessly forced upon the procrustean bed of method by some teacher who knows only one way. It is such things that bring the profession into deserved contempt, as one that has not yet emerged from blind empiricism.

The necessary combination of knowledge of the subject with knowledge of methods needs further emphasis and application. It is often supposed that the lower the grade or the more elementary the subject, the less the need of a knowledge of the subject on the part of the teacher. There can be no greater mistake if successful teaching is the end in view. In no part of educational work is flexibility in presentation and in material so necessary, as at its very beginning. Truth is many-sided, and it is always a question as to which side shall be presented. The teacher who only knows one side is hopelessly lost, and hence becomes dogmatic and useless. For instance, I know of no science teaching that demands a broader grasp of the subject-matter, and a more facile adaptation of material to purpose, than "nature study" in the lower grades. So long as it is committed to teachers with no scientific training, I predict that it will be a failure. It is in danger of becoming worse than a failure, for to atone for lack of scientific knowledge teachers are apt to have recourse to popular books upon science, full of sensational and claptrap statements, and actually mislead those whom they

are guiding. To escape from the bondage of the book, to see with our own eyes, to handle with our own hands, to judge for ourselves, cannot be brought about by the retailing of romances. Even if the teacher has enough of the scientific spirit, to say nothing of sufficient knowledge, to discard the romances, the overwhelming danger is that the pupil will be set at dead work, which when done leads to nothing. Observation merely for the sake of obervation is cruel when the world is full of important things to be observed. But how can a teacher select the important things and discard the trifling things without some fundamental knowledge of the subject? The whole race of man is peculiarly open to humbugging in the guise of science, and this will be intensified if school children are to be humbugged by their teachers. I have used as an illustration a subject with which I happen to be familiar, but fancy that it is but an illustration of all the rest. Not to prolong the discussion of this particular problem, it is my desire to impress the fact that the act of teaching demands a knowledge of subjects as well as of methods, that there may be the greatest amount of flexibility in presentation; it demands simple language and a very direct style; entire suppression of the philosophy of a subject until there are facts enough upon which to found a little simple philosophy; complete abolition of all pedagogical cant; and a reverence for truth that will not permit it to be trifled with in order to arouse a factitious interest.

My next problem is much more special, but it has long been a troublesome one, and has a certain logical connection with the one already considered. It is

2. *Science in secondary schools.*—Probably no subject has been more discussed than this one, and it seems well-nigh threadbare. School-teachers and university-teachers, in committees and conventions and addresses and periodicals, have wrestled with this problem. The school-teachers knew their pupils and their facilities, but not too much about the subjects. The university-teachers knew the subjects but very little about the pupils, and still less about the facilities. It was hard for both to occupy the same standpoint, and both were inclined to be somewhat dogmatic, the university-teacher, perhaps, a little the more so. School patrons with their demands have been a factor also. The result is what you see, and very far from satisfactory, for neither university-teachers, nor school-teachers, nor patrons can be said to be satisfied. There seems to be well nigh general consent to reduce the number of subjects masquerading under the name of science, to restrict them to a few fundamental ones, to increase as much as possible the time devoted to each one, and to insist upon the laboratory as an essential adjunct. This is advancing very far in what we believe to be the right direction, but it is more an advance in opinion that in practice. It does not become me to particularize concerning all the sciences, but I wish to make a few suggestions concerning that one with which I am identified, and the principles stated may be capable of application to all the rest.

Among the fundamental sciences botany finds a prominent place, as presenting material everywhere present and easy to handle, as entering largely into our every day lives, as peculiarly adapted to serve the variety of pur-

poses in view in a science study. As this science has been revolutionized within a few years and is still in a period of extreme revolution, the schools have found themselves strangely at variance with the universities, and are plainly and repeatedly told that their botany is an absurdity. These unpleasant statements are usually received with becoming meekness, as coming from those who are supposed to know, but have led to nothing or to chaos. The ancient type of botanical teaching, lineal descendant of the time when botany was regarded as more æsthetic than scientific, was to regard the flower as the only material worthy of examination, and the name of the plant which bore it as the ultimate fact to be learned. All consideration of plant organs was limited to their usefulness in helping to obtain some trace of this all-important name, and botany became a somewhat elaborate game of hide-and-seek. Interested publishers supplied the school with "analytical keys" for chasing the delusive name; ingenious teachers and others devised analytical blanks, in which the fleeting observations could be set down, and by which all impertinent observations could be suppressed and the observer turned into a counting machine; herbariums began to be demanded, whose value was measured by the names tagged to the specimens. Is it a wonder that botany came to be regarded as a collection of not especially attractive names? There is no doubt that such work found a ready interest in certain pupils, and that botanists have been born out of just such conditions; but the chief complaint is that this is not botany. It holds about the same relation to botany as does a collection of postage stamps to geography. The universities, after they had learned a little botany themselves, rose up and condemned this masquerade, and the universities did well; but what did they seek to substitute for it? The schools were told that a laboratory must be equipped with compound microscopes; that botany could be seen only by peering through a lens; that all the plant groups, from the lowest to highest, especially the lowest, must be passed in review. It was urged that by this method alone could there be gained any proper conception of the plant kingdom. The schools, as many as could command the specified equipment or believed in the advice, made the change. Young men and young women fresh from university laboratories were called upon to direct the work, and the schools waited to be revolutionized. It was of intense interest to me to watch the result, since my own voice was as loud as any in recommending the change, and it had the entire consent of my judgment. Numerous new books appeared, both text-books and laboratory guides, the favorite legend being "for high schools and colleges"; this time written by the college men, and, as the school-teachers soon learned, from the college standpoint, which calculates upon time and equipment and a reasonable amount of intellectual maturity. The schools began the struggle and they have been struggling ever since. I have visited numerous high schools to inspect their work in botany, schools that contain the best possible facilities for this kind of work, and I wish to give the result. Taking an excellent school as an example, I found it equipped with laboratories that put to shame those of many colleges, and the work in charge of thoroughly trained special teachers, competent to get the best results possible. The plant kingdom must be presented

in four or five months. The congested state of the schedule, however, a perfectly normal state in secondary schools, permitted only two exercises each week. Some thirty or forty exercises, therefore, of one or two hours each, represented the actual time at command. It should be said that the instructors rebelled both at the time and the field to be covered, but a Juggernaut system must override all such protests, and the result must be demanded without any reference to conditions. The plant kingdom, therefore, was marshalled through its representatives; fleeting glimpses of unknown and unrecognizable things were obtained through the microscope; that most difficult art of interpretation, without which the microscope is but a delusion and a snare, could not be cultivated; a rapid succession of unrelated objects, becoming increasingly complex and hence more difficult of interpretation, was presented in bewildering haste; the brief lectures dealt with the most fundamental and philosophical truths of biology. At the completion of the course I conferred with several of the brightest pupils and sought to discover their knowledge of the plant kingdom. It was simply confusion. Undoubtedly, there are a few favored schools where a more liberal management can show better results, but I believe that the result given is the general one. Therefore, I am ready to confess, contrary to my former honest conviction and earnest contention, that the universities made a blunder in their advice. The old method was very narrow, and very superficial, but it gave a certain kind of contact with nature. The new method is broad and philosophical, but it withdraws pupils from contact with nature and makes botany a thing of the laboratory table and the microscope. The latter needs time and some maturity, as well as equipment, to develop. There is still another phase of botany, which is coming rapidly into prominence and which is reaching sufficient organization to be utilized by the schools, which I believe is destined to be the field cultivated by secondary schools. It has all the breadth and philosophy of the morphological work that is being attempted, and a much more rational contact with nature than the old method of so-called "analysis" brought. While it is often claimed that studies are merely tools, to be thrown aside when the result has been obtained, there are certainly some subjects at least in which the content as well as the discipline is to be considered. It is very important, for example, that the pupil at some time shall come into rational contact with the phenomena of life, as presented by plants or animals or both, and this quite apart from the discipline such study is adapted to afford. These phenomena enter too much into the necessary experience of everyone to be disregarded in schemes of education. It is such a contact that the new botany brings. Plants are regarded as living things, performing a variety of operations, sensitively adapting themselves to varying external conditions, associating themselves into communities of various kinds, occupying a definite place in nature. This mass impression of plants as a whole, and of the conditions which determine their distribution and association, is the fitting introduction to more detailed study. The main trouble with the morphology work of our schools to-day, and of many of our colleges as well, is that the structures observed cannot be related properly. There is no background upon which the

details can be projected. The substitution of intelligent field-work, not collecting, for some of the laboratory work, the introduction to plant societies and the recognition of their peculiarities, the constantly deepening impression that plants are things which work as well as exist, which perceive and having preceived respond, must certainly commend itself as resulting in a worthy primary impression of the plant kingdom. It is not the superficial search for so-called flowering plants and their names; it is not the monotonous treadmill of morphological work and microscopical examination; it is that which gives significance to both, and introduces plants as living, sensitive, responsive organisms; not scattered at haphazard, but organized into communities with all sorts of mutual relations, and giving significance to every landscape; not passive and helpless, but exceedingly active and able to take care of themselves; not things to be used and admired merely, but also the great revealers of those fundamental laws of biology whose study is to lead us eventually into the deepest recesses of knowledge. The principle involved is to lead to a correct impression of general truth by means of personal contact, from which advance in any direction may be made. The preparation for such teaching is not easy, but I have long since given up the impossible task of devising some method of teaching botany, or anything else, that can be used by teachers who know nothing of the subject. The teacher who knows nothing of his subject is necessarily a failure, and it is perfect folly to try to prop him up. There is nothing for him but to stop the farce, and either learn something to teach or seek some other employment.

It must be confessed that much of the trouble with science in the secondary schools has come, not simply from teachers who know no science, but often from the lack of pedagogical instinct that compels them to adapt their training to school and pupils. They seek to establish a minature college laboratory, a laboratory peculiarly ill-adapted to school conditions. It seems to be a hard lesson for university graduates to learn, who undertake to do secondary-school work, that a secondary school is not a college, and that it demands its own peculiar kind of teaching. Slavish repetition of college work in the secondary schools is necessarily a failure. The college supplies knowledge of the subject, and the general spirit which should pervade it, but it should never be taken as an exact model for the secondary school.

3. *Nature study.*—In the same connection I wish to speak briefly of "nature study." At first sight it may seem to have little to do with the secondary schools and colleges, but from my point of view it is a subject of vital importance to the whole scheme of education. Although formally mentioned only in connection with the lower grades, it underlies the possibility of future work, and its absence accounts for the strange inequality in numbers observed in the later years of training between those with scientific tastes and those without. Any educational scheme which for years persistently excludes any phase of work must expect a comparatively small response when it is finally offered.

Under this somewhat comprehensive title of "nature study" there has entered the schools an element of teaching so fresh and vivifying, that it has come as a revelation, and will certainly work a revolution. The average

school curriculum, fairly riveted upon us by long years of precedent, seems to be established upon the idea that education consists in the presentation of subjects totally unrelated to the experience of the pupil. This conception of education could only have been held before there was a science of education founded upon some knowledge of the mental processes of the child. Since such a science has come into existence, and has begun to accumulate its facts, we have learned the absurdities of empiricism and of speculation in education, and have turned with hope to experimental psychology. Our results are comparatively few, as yet, but they are sufficient to give us some insight into the child's mind and to recognize the warping and benumbing treatment it has been receiving. We are passing from the days of pills and potions to the days of hygiene, and are seeking not to rack the mind but to preserve its normal tone. One of the first visible mental tendencies in the child mind is the spirit of inquiry aroused by natural objects. The tendency is well known, but the natural keenness of observation in the normal child was a revelation even to those who were suspecting it. By keenness, I mean rapidity and accuracy and completeness of observation. These normal children have been passing into the schools; their attention, under compulsion, has been withdrawn from what were realities to them, to the abstractions of language and numbers; they were asked to think, but not as a result of observation; the conventional completely supplanted the real; there was thinking, but no independent thinking; the fine tentacles which were born with them finally became atrophied through disuse. When years later they are introduced to some observational science work there is a clumsiness of effort, a lack of spontaneity, an overwhelming sense of strangeness that is pitiful to see. Hundreds of such cases have I seen, and so completely has the school done its work that only here and there can a few be found whose old natural power can be in a measure restored. We have been taking a normal, healthy, powerful, God-given impulse of the human mind and have ruthlessly maimed and crippled it. The result may not be so obvious as the maiming of feet practised by Chinese women, but it belongs to the same category and is infinitely more cruel. Into this condition of things nature study came, and it met the greatest need in the education of children. It is difficult work, very difficult work, and a blunderer may make a sorry showing, but so he will in anything that takes training and judgment. It meets the child on the threshold of school as the one familiar face. It satisfies and keeps active important powers to whose trained service he is entitled throughout life. It relates his school life and hence all his life to the great world of nature about him, full as it is of wisdom, of pleasure, of comfort, to those who can see. I cannot understand how we were ever so educationally blind as deliberately to eradicate nature from the lives of children and to send them out into a world robbed of half its significance.

It may be well to make a somewhat definite statement of the principles that should obtain in "nature study," and I wish to preface this by a few criticisms upon observed methods. It must be confessed in the outset that nature study as yet is largely in the hands of unprepared teachers, who have had it thrust upon them, and who are more or less conscious of their helpless-

ness. Further, quite a number of the reputed leaders in the subject are distinctly "blind leaders of the blind." As a consequence, nature study today is an ill-defined, inchoate thing, the despair of the primary teacher and the joke of the scientific fraternity. And yet, its purpose is sound, and it is bound to outgrow its youthful ailments. It is certainly a great problem, to be solved by extensive experiment rather than by preconceived notions. All statements of principles, such as I am about to make, must be regarded merely as statements of working hypotheses, until they are established or set aside through experience.

My first criticism of observed methods is directed against what I have been in the habit of calling "dead work," which means the observation of insignificant, trivial things, work that means nothing when it is done. I realize that many a teacher, through lack of knowledge, is compelled to occupy the time with anything that occurs to her, and sometimes she is honest enough to call the exercise "busy work." For example, I have seen period after period given to the study of forms of leaves, chiefly because the forms are endless, and illustrative material is easily obtained. It would seem to be a crime, except that the criminal intent is lacking, to waste a pupil's time with meaningless observations when the world is crowded full of important things waiting to be observed. Of course it demands a little knowledge on the part of the teacher to distinguish between the important and the trivial.

A second criticism of observed methods is the attempt to arouse a factitious interest in nature study by all sorts of playful and imaginative devices. Most of the books dealing with nature study cater to this tendency, and perhaps are largely responsible for it. These devices disgust strong children, just as does the foolish and forced sprightliness of many primary teachers. The whole business is as confusing and benumbing as "baby talk." But the serious point is that "nature study," imbedded as it is in conventional education, is the one chance for exact and independent observation, for cultivating the ideas that between cause and effect there can be no hiatus, that imagination is beautiful and most useful in its place but that its place is never to lead to a misconception of facts, and that there should be no playing fast and loose with truth.

It seems to me that a fundamental statement concerning nature study is that it is to keep functional what I have called the "tentacles of inquiry." It follows that a test of success is *interest.* It is evident, therefore, that no science can be presented in any completeness or in any definitely organized sequence, and hence the purpose must be *continuity of interest* and not *continuity of subject.* The resulting interest must be checked by the objects of interest, which must be important, and so I reach my general thesis that *nature study must look to a continuity of interest in important subjects.*

What are appropriate subjects? I would suggest an answer under three heads: (1) *Things of common experience.* This means that there can be no fixed schedule appropriate for every school, and it also means an adaptable teacher. The teacher who has secured a definite "outline" from some one is in danger of passing by the most important natural objects

within reach of the schools. I have seen such an "outline" prepared on the seacoast and being used by a teacher in the central west. When it came to the subject of seaweeds, a few miserable things were obtained with much difficulty from the seashore, and the glorious forest with which the school was surrounded was left without observation! This is an extreme case, but essentially the same thing is common enough. (2) *No subject should be pressed too far,* for interest may pass into disgust. Watch the pupil, not the outline! (3) *Observation should be directed more toward activity than towards form and structure.* It is fundamental in botany that plants be regarded as things alive and at work; and it is also of far greater interest to a child to watch a plant doing something than to observe form and structure, which in the very nature of things mean nothing to the observer.

What are appropriate methods? (1) Very definite work, that has already been traversed by the teacher; for it is confusing and discouraging and disastrous to work at random; some very definite result must be plainly in sight; (2) individual work in observation or experiment, which means personal responsibility; (3) unprejudiced observation, which means that the pupil is not to be told what ought to be seen; some children are so docile that they never fail to see what they are told to see; (4) bringing together and comparing individual results, a thing of fundamental importance, for it develops differences in results which must be settled by repetition, shows what is essential in the results and what amount of variation is possible, develops the habit of caution in generalization, and impresses the need and nature of adequate proof.

What are the appropriate results? (1) A sustained interest in natural objects and the phenomena of nature; (2) an independence in observation and conclusion; (3) some conception as to what an exact statement is; (4) some conception of what constitutes proof; in short, an independent, rational individual, such as the world needs today more than anything else. I feel strongly that our educational system lacks efficiency in just this direction, and that continuous training in exact observation and inference, beginning with the kindergarten, must result in more sanity among adults.

There seems to be abroad a notion that one may start with a single well-attested fact, and by some logical machinery construct an elaborate system and reach an authentic conclusion, much as the world imagined for more than a century that Cuvier could do if a single bone were furnished him. The result is bad, even though the fact may have an unclouded title. But it too often happens that great superstructures have been reared upon a fact which is claimed rather than demonstrated.

We are not called upon to construct a theory of the universe even upon every well-attested fact, and the sooner this is learned the more time will be saved and the more functional will the observing powers remain. Facts are like stepping stones; so long as one can get a reasonably close series of them he can make some progress in a given direction, but when he steps beyond them he flounders. As one travels away from a fact, its significance in any conclusion becomes more and more attenuated, until presently the vanishing point is reached, like the rays of light from a candle. A fact is really only

influential in its own immediate vicinity; but the whole structure of many a system lies in the region beyond the vanishing point.

We must wonder what lies beyond, we must try our wings in an excursion now and then, but very much stress must never be laid upon the value of the results thus obtained.

Such "vain imaginings" are delightfully seductive to many people, whose life and conduct are even shaped by them. I have been amazed at the large development of this phase of emotional insantiy, commonly masquerading under the name of "subtle thinking." Perhaps the name is expressive enough, if it means thinking without any material for thought. And is not this one great danger of our educational system, when special stress is laid upon training? There is danger of setting to work a mental machine without giving it suitable material upon which it may operate, and it reacts upon itself, resulting in a sort of mental chaos. An active mind turned in upon itself, without any valuable objective material, can certainly never reach any very reliable results.

It may not be that nature study and laboratory science in education are the only agencies, apart from common sense, that are correcting this tendency, but they certainly teach most impressively, by object lessons which are concrete and hence easiest to grasp, that it is dangerous to stray away very far from the facts, and that the further one strays away the more dangerous it becomes, and almost inevitably leads to self-deception. It is from such a fate that people must be saved, and the time to begin is in the primary school, with nature study from which imagination and emotion are largely eliminated and the pupils are held rigidly to the facts.

4. *The schools and the universities.*—This problem, so far from being solved, is getting into a condition so involved that its future status is very uncertain. Questions of entrance requirements, of examination or certificate, represent the border line problems that interest schools and universities alike. As a rule, so far as the high schools are concerned, the state universities have determined these standards, and as a rule the other universities, in self defense, have followed them. From the standpoint of the university, the high school exists to prepare university students. From the standpoint of the high school, its primary function may be somewhat different. The university, and especially the state university, cannot afford to disarticulate itself from the rest of the school system; on the other hand the high school cannot afford to lose the uplift of the university. Universities, as a rule, are great storehouses of educational precedents, which have descended from mediæval times, when there were very few subjects organized for study, and these few held little or no relation to the problems of intelligent living. They were the possession and pastime of a favored few. Heredity has filled the blood of most universities with this so-called scholastic spirit, so that they find it hard to adapt themselves to the new conditions. The cut of one's education has come to be as formal as the cut of his dress coat. It should be remembered that the old selection of subjects was a matter of necessity rather than of choice; but since the opportunity for ample choice

has come, the old necessity no longer exists, although it is the tendency of most universities to regard the older subjects and the older methods as possessing a peculiar relation to education. On the other hand, the American school system is peculiarly a modern institution, developed out of the necessities of our own civilization, and seeking to meet the demands of the time. The schools are handicapped by no precedents, and have no heirloom rubbish to intercalate among their modern furniture. To the thoughtful student of education it is intensely interesting to watch the progress of the effort to articulate the very old, as represented by universities, with the very new, as represented by schools. It was necessary that it should lead to clashing opinions, and that the old and the new should mutually scoff at one another. The old had the advantage of that dignity and influence which belong to years and an honorable history; the new had the advantage of numbers and public opinion. Neither could dictate to the other, though both wanted to. It is really quite remarkable that the two have gotten along so well together, and this argues well for the deep-rooted belief of each that it must have the other. In the main, however, the universities have imposed more upon the schools than they have conceded; as is very apt to be the case when the weight of educational authority is largely upon one side. It is hard for the universities to lay aside the thought that the high schools are primarily preparatory schools. If this be conceded, then the universities must be permitted to dictate the courses of study. But it is not conceded, and still the universities have in effect dictated the courses. They have done it by making the entrance requirements so specific and so numerous that the four years of high-school are absolutely filled with them. If there is anything for a high school to do besides preparing students for college it either has no time for it or is compelled to organize a separate and independent curriculum which does not lead to college. Most schools are so situated that they cannot do both. The colleges are honest in their opinion that their entrance requirements represent the very best education for a student of that grade whether he is to enter college or not. I have helped express and enforce this opinion, and so cannot be accused of any undue prejudice if I now venture to dissent from it. I still think that a large part of the university entrance requirement represents the very wisest subjects that can enter into the curriculum of the high school; but when these requirements become so large and so specific that they destroy the educational autonomy of the high school, and convert it into a university appendage, then I am constrained to dissent. The increasing standards are to permit more advanced work in the university, and this is a magnificent purpose, to be encouraged by every true lover of education; but it must not be done at the expense of schools the great mass of whose students never enter the university. It is wise to introduce into the high school studies which may be of no special benefit to the pupil preparing for college, for they are of great benefit to the lives of those whose educational career must end with the high school. As I understand it, the high school is intended to train for better citizenship, to enlarge the opportunity for obtaining a better livelihood, to open broader views of life and its duties. In order

to be of the greatest benefit to the greatest number, its course of study must be constructed as though there were to be no further formal education for the pupil. Subjects must be related to the needs of life and of society, but this need not and should not exclude those subjects or those methods which prepare and stimulate for further study, for there should be constant recognition of the fact that the secondary school is but an intermediate stage in educational progress. I regard the recent tendency of universities to increase their demands upon the schools as unwise, and as fraught with danger. It has long been my theory that the specific demands may be very few, and these so self evident that a school would not be likely to omit them. What the universities need is not a specific kind of preparation, but a certain degree of intellectual development, a development which is usually much broader than that obtained from the average college preparation. I may be allowed to say, as the result of many years of experience, that this average college preparation presents to the universities the most narrow and unevenly trained material that can be imagined. Nowhere are the evils of specialization so apparent as in the entrance preparation demanded by most colleges. If this specialization results in comparatively poor college material, its results may be regarded as simply disastrous to the high school in its primary purpose. This is not a plea for the multiplication of studies in the high schools, for one of their great weaknesses today is their tremendously congested condition. It is a plea for the relief of this congestion by reducing the university demands, not in quantity, but in specific assignment, leaving the schools freer to exercise their own judgment in the selection of special subjects. The time has long passed when any aristocracy of subjects has any right to claim the privilege of standing guard over every avenue leading to a higher education. Any student who has successfully pursued a well-organized and coherent course for four years in a high school should be able to continue his work in the universities. There are differences of opinion as to what constitutes a well-organized and coherent course, but it could be outlined by principles rather than in detail, and the schools themselves should be responsible for its construction. A minimum of subjects and a maximum of time, continuous rather than scattered work, a range broad enough to touch upon all of the fundamental regions of work, methods that will secure precision in thought and expression, contact with the life and work of the times in which we are destined to live, are certainly principles that are sufficient, but concerning whose details none should dogmatize, for they may well vary with the teachers, and the local conditions. For instance, to require botany, when the teacher is far better equipped for zoology, is simply nonsense, an illustration which finds its parallel in every region of work. The university should always be called upon for advice as to courses and methods, but it should be from the standpoint of the schools, a standpoint best determined by the schools themselves. For instance, I would not presume to dictate to any school the way in which botany must be taught; but I would count it a privilege, upon being made acquainted with the preparation of the teacher, and the facilities at command, to suggest certain

lines of work, from which as a rational being, knowing the condition better than any one else, he could make his choice. I would regard it as my chief function to guard inexperience against waste of time and energy, rather than to specifically direct. If the teacher did not know enough to make a choice in such matters, I would advise the selection of some other means of making a living. I must confess to being a great stickler for individual independence and responsibility, and that school or that teacher which is held in the dictatorial grasp of some higher authority which permits no expression of individualism in methods, which sternly represses all spontaneity and originality, which demands an automaton-like service, is pedagogically blighted. The vast machinery of the schools which enters into every petty detail, rides them like the old man of the sea, and is converting schools into factories, and teachers into drudges.

And how shall well prepared material be recognized at the university? Lately the entrance examination system has thrust itself upon my attention afresh. I do not know whether this ghost of a dead past stalks into your educational banquets or not, but it is rampant in certain universities that rather pride themselves upon being haunted. A better scheme to show how not to do it was never devised. At the present day it is peculiar to the Chinese theory of education, and that nation should be allowed its exclusive use. It is both barbarous and unscientific. I would make no serious objection to its barbarity, if it were scientific, that is, if it obtained the information it seeks. What teacher does not recognize that the estimate of the ordinary examination must be tempered by knowledge of the daily work, or grave injustice may be done? How much greater the need of this tempering in the extraordinary entrance examination! If the tempering is necessary to obtain the facts, why not substitute the tempering entirely for the examination? Which means, of course, the substitution of the daily knowledge of the teacher for the ignorance of the university examiner. I wish no better evidence concerning the intellectual equipment of a candidate for entrance into a university than the judgment of the teachers with whom he has worked, for I can get no better, nor any other half so good.

It is strange that the universities are more concerned about their raw material than about their finished product. If they would be a little less sensitive concerning entrance requirements, and a little more particular concerning graduation requirements it might be a better expenditure of energy. It has always seemed to me that the fine-meshed sieve is set at the wrong end of the university.

In conclusion, it must be repeated that no complete change in these matters which I have presented, and in others of equal importance, can come suddenly. We can be dissatisfied with the results, and can point out defects here and there which in our judgment are responsible for them, but certainly no single opinion should be followed. The subject is too vast in its importance and in its ramifications to be grasped by any one man. Its many sides confound our best judgment. It is always easy to rail at the existing order of things in a pessimistic way, and such railing is only productive of

evil. But criticism, born of intense love for the cause of education, and longing for its best development, is always helpful. Such thoughts are at work like leaven, and when they shall have permeated sufficiently, movements will begin, quietly and moderately it is to be hoped, but persistently, and out of the movements there will slowly arise new methods, which upon trial have met with general consent. No student of our educational institutions can fail to observe that the general progress towards better things has been recently very rapid, probably as rapid as is safe for wise organization. We can afford to be optimistic at the outlook, and need only concern ourselves with recognizing and attacking the points of weakness, some of which always exist to give us occupation. There is within our educational system, not perfection, unless it be in its ultimate purpose, but a wonderful power of endless development. We are to establish an American system of education, not copied from ancient times or other countries, but drawing from them all that is appropriate, and adding our own ideals, we are to meet conditions for which we find no precedent. To such great service are you called, and it will demand not only your enthusiastic and unselfish devotion to the cause of education, but your best thought and calmest judgment as educators, and your most competent work as teachers.

OVERPRESSURE, ANCIENT AND MODERN.

W. H. PAYNE.

In the Capitoline Museum in Rome there is one large hall devoted to odds and ends, the *disjecta membra* of many pieces of sculpture. Occasionally an entire piece has escaped the graver accidents of time and has come down to us nearly intact. There is such a piece crowded close to one of the walls of the hall, and made almost inaccessible by statues of indifferent merit standing before it.* It is a funereal monument that would naturally appeal to a schoolmaster's heart. It is about four feet in height, three in breadth, and two in thickness; and in the niche in front there stands the statuette of a Roman schoolboy holding a manuscript in his left hand. On the base of the monument there is a Latin inscription giving us a lamentable account of the untimely fate that befell this poor boy, Sulpicius Maximus, in his twelfth year.

The Emperor Domitian was a promoter of learning, having, among other things, called Quintilian to direct the education of his grand-nephews.

*Through the good offices of expert photographers, I secured two good views of this monument and an excellent copy of its inscriptions, Greek and Roman, in papier-maché.

Availing himself of this material, Mr. J. Raleigh Nelson wrote the interesting article entitled, "The Boy Poet, Sulpicius—A Tragedy of Roman Education," which was read at the last meeting of the Schoolmasters' Club, and published in May, 1903, in *The School Review*.

Greek learning had become fashionable in Rome, taking precedence over Latin in the discipline of the schools. In order to promote the new learning, the Emperor offered a prize for the best improvised piece of Greek verse. There were fifty-two contestants, and among them the boy Sulpicius. The occasion was one of unusual character. Success meant the approbation of the Emperor, and possibly some form of preferment. Excitement ran high. As we may suppose, emotion was tense; mind and brain were overtaxed. The boy finished his poem, but the effort cost him his life. This monument was the parents' tribute to the memory of their lost son, and the Greek verse that was the occasion of his taking off, is carefully inscribed on the sides of this commemorative marble. Had the inscription been written in our vernacular it might have stood:—

SULPICIUS MAXIMUS
Died of Greek verse
In his twelfth year
Farewell! Farewell!!

What happened in the case of this Roman student is no doubt typical of what happened in many other cases, and justifies us in saying that overpressure was a school disease in ancient as well as in modern times, though there are reasons why this disease is more prevalent now than then.

During the years of my superintendency it not infrequently happened that complaints reached me from parents that their children were being overtaxed with work, to the great injury of both mind and body; and it was not a rare occurrence that reputable physicians entered formal protests against what they believed to be an evil of great magnitude, contending that permanent injury was likely to befall pupils from the senseless practice of cramming. Very naturally my sympathies were with the teachers as against parents and physicians, my professional loyalty seeming to require me to discount the alledged evils. Subsequent experience and a more judicial view of the facts in the case have convinced me, that, in the main, parents and physicians were right, and I and the teachers wrong.

I think it may be said with soberness and truth that in our secondary and higher institutions of learning the exactions made of students in the way of imposed tasks, virtually compel them to violate every principle of school hygiene. For example, Alexander Bain states* that there is a natural antagonism between an active brain and an active stomach, and that for this reason intellectual work should not be undertaken until two or three hours after the morning meal; but the practice of our schools makes it virtually impossible to pay heed to this primary hygienic law. In this brief paper, I am not so much concerned with the hygienic aspect of cramming as with its sinister effects on the intellectual life.

In a notable paragraph in his *Education,* entitled "Mental Strain," Mr. Spencer makes the following statement:—"It [cramming] is a mistake, also,

**Education as a Science,* pp. 12, 26.

QUINTUS SULPICIUS MAXIMUS

inasmuch as it assumes that the acquisition of knowledge is everything, and forgets that a much more important matter is the organization of knowledge, for which time and spontaneous thinking are requisite. * * * * It is not the knowledge stored up as intellectual fat which is of value, but that which is turned into intellectual muscle."* Time and spontaneous thinking! Who has ever known a college student who had time for such thinking, that is, that leisurely thinking which is involved in rumination, or the analysis and assimilation of knowledge? In the learning process there are two modes of thinking which should be sharply distinguished. In one case the mind is forced to work at high tension; while in the other, it is allowed to work at low tension, following its automatic bent. The first mode is seen in what is called drill or discipline; the second in what are called culture subjects like literature or history, where the purpose is the elaboration or organization of knowledge. A drill subject like algebra loses its proper education value when taught by the discursive or low tension method, while a culture subject loses its peculiar charm and value when taught by high pressure methods. Both modes of procedure are correct in their place, but wrong when transposed. When knowledge is to be organized, that is, transformed into structure, the movement of the mind is of the automatic or spontaneous order, in which the indispensible element is time.

It seems to be quite generally assumed by teachers that the aim of school instruction should be discipline or training. I fancy such teachers have been led astray by a false etymology. How many well intended but profitless homilies have been uttered on the magic or mystic virtues of *educre!* In the first place the derivation of the term *education* from *educre* is doubtless a mistake. The proper derivatives would be *eduction* and *eductor.* The root idea in *educre* is leadership, and not *drawing out,* as alledged. The fundamental and characteristic idea in education is nurture, the proper derivation of the term being from *educare,* meaning to nurture or to foster, education being the act of nourishing, and educator one whose function is to nourish. A school is to be judged not by the few who survive the rigors of its discipline, but rather by the many who profit by its nurture. †

Sometimes the best way to make progress is to return towards an abandoned ideal. According to the Greek conception, school is a place of leisure; and according to the Roman, a place of enjoyment or of play, but in our day there is nothing farther removed from recreation and leisure than our high pressure schools.

The evil I am criticising consists in focusing the mental powers on the process of accumulation, leaving them little or no leisure for the work of

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**Education* (Bardeen), p. 286.

†"*The school must nourish the souls of its pupils,* and the only nourishment possible is ideas. There may be other tasks—there are; the soul must be exercised and trained as well as fed; but the feeding is the first and essential thing, and the richest food of all—that which best of all builds up moral fibre—is the humanistic food that comes down to us from the past in the form of fairy tale, biography, history, and literature."—F. H. Hayward, *The Secret of Herbert,* p. 71.

organization, for which, as Mr. Spencer declares, time and spontaneous thinking are requisite. The years of college life are made too largely a grazing period, in which there is but little opportunity for rumination or meditation. The question I raise is whether a milder stress should not be placed on the process of accumulation, so that, during his college course, the student may make some substantial progress in education proper. I have wondered whether some beneficent millionaire of the Carnegie type might not endow an institution which in its programmes of study would make ample provision both for the accumulation of knowledge, and for its organization or transformation into intellectual structure, or intellectual muscle, using Mr. Spencer's phrase. I can think of no educational reform of greater difficulty or of higher utility. A feature of Hubartianism which can not be esteemed too highly is the duty it places on teachers to assist pupils in assimilating the knowledge constituting the circle of thought. The doctrine of apperception finds its justification and its value in the fact that it is an assimilative process, quite distinct from the process of acquisition, though presupposing it. Mental cramming is very like the feeding process which may be observed in railway eating-rooms where travelers feel constrained by the pressure of time, to bolt their food, rather than to eat it in the leisurely way prescribed by dietetics.

The so-called enrichment of our school courses is largely responsible for the evils of cramming. Each ambitious specialist demands a place on the programme for the subject which is the especial object of his regard. Professional zeal is to be commended when hemmed in by competing subjects, but it easily passes beyond proper metes and bounds when it inspires a strong and aggressive personality. We can live on friendly terms with a man who asserts that there is nothing like leather, but we can scarcely abide one who contends that there is nothing but leather. As long as this overcrowding of programmes continues, and there are no signs of a halt appearing, there seems to be no hope of a saner educational régime.

Here is another case in which we may make substantial progress by turning backward.

In his "History of Greece," Curtius makes the following remark:—"The mental culture [of the Athenians] was but plain and simple, yet it took hold of the entire man; and this all the more deeply and thoroughly because the youthful mind was not distracted by a multiplicity of subjects and could therefore more closely devote itself to the mental food and to the materials of culture offered to it." (Vol. II., p. 416.)

Mahaffy, in his *Old Greek Education,* speaks to the same effect as follows:—"Neither was there in old days that multitude of special subjects, totally unconnected with each other or with a liberal education, which now infests our educational establishments, and causes the hurry after tangible results to displace the only true outcome of a higher education—that capacity to think consecutively and clearly, which is to be acquired by studying a logical and thoroughly articulated branch of knowledge for the sake of its accuracy and method." (P. 137.)

The complexity which in these later days has succeeded the old-time simplicity is temperately stated by Mr. Wilson Farrand, Head Master of the Newark Academy, in his article on "The Existing Relations Between School and College":—"It is not enough," he says, "that the child should learn to handle skillfully the tools of all learning—the three R's; his sense of form and his aesthetic nature must be developed by drawing; his hand must be trained by manual work; his musical nature must be awakened by song; he must be brought into harmony with his external environment by means of nature lessons and the study of science; his patriotic impulse must be roused by the study of American history and by flag drills; temperance must be instilled into him by lessons in physiology with special reference to the effect of alcohol on the human system; his imagination must be cultivated by means of acquaintance with Greek and Norse mythology; he should gain some knowledge of the great heroes and events of general history; through the plentiful reading of masterpieces he should acquire a love for and an appreciation of the best literature, while at the same time his mind should be stocked with choice gems of prose and poetry that will be a solace and a comfort to him throughout his later life; it will be well if by displacing a little arithmetic or geography he can gain some knowledge of the elements of Latin or of modern language; in some manner there should be roused in him a love for trees, a respect for birds, an antipathy to cigarettes, and an ambition for clean streets; and somehow, somewhere in this wild chaos, he must learn to spell! All these things, together with sewing, cooking, carpentry, principles of morality, and gymnastic exercise can easily be acquired in the grammar grades, provided only we have good teaching and proper economy of effort. Do you wonder that sometimes teachers in progressive schools confide to us that they fear their pupils are slightly bewildered? Do you wonder that pupils do not gain the habit and the power of concentrated, consecutive work?"

Rousseau declares that we no longer know how to be simple in anything. All reforms consist essentially in a return towards simplicity. How hopelessly complex our courses of study have become! How bewildering it is to think what they are likely to become if prevailing tendencies remain unchecked! We are bound to recollect that times are changed and that we are changed with them. No one in these days would dream of recommending a sheer return to the Seven Liberal Arts; but on this scanty bill of intellectual fare it was easily possible to produce what is almost an impossibility in modern times,—a liberally educated man.

The quotation from Mr. Farrand recalls a scene that occurred in the church of Santa Croce in Florence. This ancient Gothic church is rich in those art treasures of inestimable value which have made Florence "the joy of the whole earth," and each year witnesses throngs of visitors, attracted either by vain curiosity or by a sincere purpose to gain inspiration and spiritual insight through the ministrations of art in its various forms. It goes without saying that for this purpose time and meditation are necessary. As photographers would say, there must be an *exposure,* for a longer or a

shorter period of time, depending on the resources and taste of the visitor. Any attempt to grasp all would result in losing all. In order that some things may be adequately seen many other things must remain unseen.

On the occasion referred to there was an irruption into this church of Holy Cross by a party of American tourists, numbering sixty. It was a "personally conducted" party with a leader of the strenuous order who stood not on the order of his going. I seem still to hear his orders, given in strident tones:—"Come on!" "Hurry up!" "Put up your note books!" etc., etc. Then followed a sort of scurry from tomb to tomb, through aisles and chapels, till the door of exit was reached and the party disappeared to repeat the farce at some other place of note. These countrymen of mine *had done* the church of Santa Croce in just fifteen minutes by actual count. Racing through a cathedral is very like racing through an over-crowded course of study, and one is just as defensible as the other.*

But a pernicious source of undue mental strain remains to be noted,—I mean examinations which are made to involve the fate of students for good or for evil. The evil in this case is often a double one:—the severity of the examination may be inordinate, and the consequences of failure may be a blight on the student's future life. An actual case may best illustrate my meaning: In a school of collegiate grade it was the custom to subject the first-year class to a mid-year examination of such severity that half of its members failed to reach the arbitrary standard set for passing, and so were sent home under the cloud of failure. It is easy to see how by tradition this examination became to each incoming student a terror in prospect. As a matter of fact, the nervous dread of this impending crisis fell as a blight upon the lower ranks of the school, and unfitted even well qualified students for passing this dreadful ordeal with even moderate credit. Naturally enough, when the cause of this nervous disturbance had been removed, the fear of an impending evil continued to affect the school, just as the throbbing of the ocean continues after the storm has passed.

An examination on which so much is made to depend may be as fatal in its way as a Gatling gun. Through this secular abuse of power, is it any

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*Two members of the Rolling Stone Club, of Medina, N. Y., have written a book telling how to "do" Europe on $4 a day. "Florence is a dream," they say. "We came for three days and staid five, and dragged ourselves away unwillingly. Yet it can be done in a day, and we saw it being done in that way more than once. The Baptistery is noted for its beautiful bronze doors. We were standing one day before the pair by Ghiberti, when a fine equipage whirled up. Two exceedingly prosperous looking Americans, with their wives, occupied the seats."

"'These are the doors,' droned the guide on the box seat, 'that Michael Angelo said were good enough for heaven.'

"'All right,' said one of the jovial tourists, looking at his watch, we'll trust his judgment. Let 'em run!'

"And as they were whisked away after just five seconds before one of the most artistic creations in Europe, we saw the man who sat with his back to the driver, nearly dislocate his neck as he twisted around to ask:

"'Who'd you say said that?'

"And the Limited having passed, we resumed our leisurely enjoyment of the masterpieces."—*N. Y. Tribune.*

wonder that in too many cases, students look upon their instructors as their natural enemies whom they may properly circumvent by ruse and fraud? I am far from thinking that the case cited is a common one, but I maintain that the evil *in kind* is frightfully common. The evil consequences of such mental strain are for the most part occult, only the graver consequences coming to the surface; but if an actual inquest could be made, the showing would be a blot on our so-called higher education. It should be remembered that one of the crudest instruments in the hands of teachers is the examination. Its abuses are so common and so flagrant as almost to justify its disuse, and its shortcomings should give pause to those who employ it as a test. It does not bring to the surface the finer qualities of spirit which constitute character, such as faith, hope, charity, but rateher the coarser qualities of mind such as memory, imitation, rote-learning, etc., etc.

A few years ago, in a certain western state, an item to this effect went the rounds of the newspapers: "This has been examination week in our University, and the results attest the high quality of work done by our Professors. In one case, out of a class numbering nearly one hundred, only sixty were passed, the remainder being either conditioned or not passed. We think this is conclusive proof that our University is rapidly coming to the front as an institution for dispensing the higher education." More correctly stated this item would run as follows: "Professor X has taught his large class in his own way, has examined it in his own way, and his work has been so well done that only sixty per cent of his students could stand the test which he applied to them."

THE LEADERSHIP OF THE FEDERAL GOVERNMENT IN PUBLIC EDUCATION.

R. H. JESSE, PRESIDENT OF THE UNIVERSITY OF MISSOURI.

Few, even among intelligent people, realize to how great an extent the general Government has led the States and the people of our country in public education. We are prone to think of this progressive state, or this enlightened man, or that seat of learning as leading our people aright, forgetting that oftentimes the general Government has whirled onward in education, states, with their leaders and their seats of learning.

In 1787 the Continental Congress, shortly before it passed out of American history, passed an Ordinance for the government of the Northwest Territory, which means for that territory which lies west of the Allegheny Mountains, east of the Mississippi River, north of the Ohio, and south of Canada. This document contained, in Article III, this remarkable sentence: "Religion, morality and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged." This policy was confined to the Northwest Territory, but it has since been extended by the general Government to all the

territory west of the Allegheny Mountains, excepting only Texas and West Virginia. This sentence, indeed, has proved to be the Magna Charta of public education in the United States. This I shall point out later. In 1789 the Continental Congress had passed away, the Constitution had been adopted, Washington had taken his seat as President and the first Congress was holding its first session. Early in the session an amendment to the Ordinance of 1787 was adopted. This amendment was intended to bring the Ordinance into harmony with the new form of government and thereby to perpetuate it. Therefore, the amendment was practically a re-enactment of the Ordinance of 1787. This amendment and re-enactment was signed by George Washington. We are glad to bring into connection with this immortal Ordinance the name of him whom we proudly call "Father of our Country." Almost immediately after the passage of the Ordinance of 1789 the general Government made with the Ohio Company a contract whereby a large territory in that commonwealth should be open to settlement, upon certain conditions. One of these conditions was that the sixteenth section in each township should be reserved for the public schools and that two entire townships, each consisting of thirty-six sections, should be reserved for the endowment of a "Seminary of Learning," which, being interpreted into the language of today, would mean, a Seminary of Higher Learning, and which became a State University. These conditions were imposed in accordance with that sentence in the Ordinance of 1787 which declares that throughout the Northwest Territory, "Schools and the means of education shall forever be encouraged." This sentence is the Magna Charta of the public school system, and in fulfillment of its provisions, these conditions were laid upon the early settlers of Ohio. The same conditions were afterwards laid upon other states formed out of the Northwest Territory, and they were, at a still later time, extended to the states carved out of the Northwest Territory, and they were, at a still later time, extended to the Louisiana Purchase and to other states otherwise acquired. Whenever a territory west of the Allegheny Mountains knocked upon the doors of Congress asking for admission to the sisterhood of states, certain conditions were imposed upon the territory by the general Government. If the territory, by popular vote, pledged itself to carry out these conditions, it was admitted to the Union, but otherwise it was not admitted. One of these conditions was that the sixteenth section of land in each township should be reserved for public schools, and another was that, in general, two townships, of thirty-six sections each, should be reserved for the endowment of a Seminary of Learning, which, in every case, was interpreted to mean a State University. In pursuance of the educational policy contained in the Ordinance of 1787, the general Government required each territory in the country west of the Allegheny Mountains to take a certain stand in behalf of public education, elementary and higher, before it should be admitted to the Union. The people of these early territories do not seem to have been generally zealous in behalf of education. They accepted the conditions imposed by the general Government because without such acceptance they could not enter the Union;

but some of them long neglected their universities so far as the conditions imposed by the general Government permitted. For nearly thirty years the Legislature of Michigan did not give to the University at Ann Arbor a single dollar, but left it to maintain itself wholly upon the proceeds of the Federal lands and upon tuition fees. In Missouri the Legislature took no steps to found the University until nearly twenty years after the state had been admitted to the Union. When the University was finally established, it was suffered to starve for twenty-seven years without the gift of a cent from the State Treasury. The first appropriation was $10,000 for the space of two years. Then came appropriations, slowly increasing, but it was not until the University was fifty-one years old that the maternal affection of the state towards its greatest institution began to be manifested in really worthy degree. It would seem that in many cases the Federal Government led, rather unwillingly, states, so far as higher learning, at least, is concerned. Texas and West Virginia are the only states west of the Allegheny Mountains that have been admitted to the Union without conditions committing them to a public school system from the elementary forms to the university. Texas was admitted in the troublous times attendant upon the Mexican War and West Virginia was torn from the old dominions amid the horrors of civil war and as a stroke of war policy. In view of these facts, who can deny the statement that from the crest of the Allegheny Mountains to the shores of the Pacific Ocean, the Federal Government has been leading the states and their people, sometimes rather against their will, into wise policies in public education.

No account of education by the state, or by the United States, would be complete without some account of the work of Thomas Jefferson. His services as author of the Declaration of Independence, as statesman, diplomat, cabinet minister, and President have obscured the services which Jefferson rendered to education. In 1779, three years after he wrote the Declaration of Independence, Jefferson introduced into the House of Burgesses in Virginia a bill establishing in that commonwealth a comprehensive system of public schools. His bill provided for elementary schools, secondary schools, and at the head of all such a State University as has not yet been realized in our country. The bill attracted great attention at the time, but it should not seem strange that, amid the sorrows of the Revolutionary War, it came to naught. From 1779 until his death in 1826, Jefferson was dominated by a passion for freedom through republican institutions, and by a passion for public schools at public expense. For forty-seven years, with tongue and pen, in public and in private, he pleaded the cause of public education without rest or abatement. When we remember his exalted position, his wide acquaintance with public men, his enormous correspondence, his dominating passions, we can gather an adequate idea of how great an influence he wielded in behalf of education. His name may not be connected with any great act in behalf of schools. Indeed, his ideas of the Constitution rather prevented him from advocating education at national expense, but for nearly a half century he was the foremost advocate in all our land for state aid for public education from the elementary forms through the ideal

State University. It is impossible to exaggerate the influence which he exerted in fastening in the minds of the people of our entire country the idea that public money ought to be used liberally by the states for public education. The last years of his life were spent in a prolonged struggle to induce Virginia to adopt his plan of public education. For reasons that pass our comprehension, Virginia refused to establish elementary or high schools. It did finally establish a State University but it was only a tithe of that University of which Jefferson had fondly dreamed.

In 1858 Justin S. Morrill of Vermont introduced into the Senate of the United States a bill establishing agricultural colleges. The measure was passed by a small majority but it was vetoed by President Buchanan, who showed genius for doing unfortunate things. In 1862, amid the horrors of civil strife, Senator Morrill introduced his bill again with slight modifications. Again it was passed by Congress and was signed by Abraham Lincoln. We are glad to connect this wise measure in behalf of higher education with the name of him whom we may justly call the second Father of his Country, and the Author of the Second Declaration of American Independence. The Morrill Act offered 30,000 acres of land belonging to the general Government to each state for each congressman and senator that it had at the time when the Act was passed. Certain conditions were prescribed to which each state had to conform in order to inherit the federal bounty. The Government made gifts to the state in behalf of higher public education with one hand and with the other hand led these states into a certain attitude before they became recipients of the gifts. These institutions were intended to be colleges in the true sense of the term. In standards of admission, in standards of graduation, in courses of instruction, they were to be real colleges. They were at liberty to teach anything, even including the classic languages, that was taught in other colleges, but it was provided that agriculture and the mechanic arts should have a prominent place in the curriculum. Some states were wise enough to place these colleges in their universities, but some were unwise enough to establish them on separate foundations. The colleges of agriculture that have been founded in universities are destined, I dare affirm, to far excel those that rest on separate foundations; while the State Universities that are fortunate enough to have these colleges in their midst, are destined to excel the other State Universities. The conjunction is full of blessing to the college and also to the University.

In 1887, just a hundred years after the passage of the great Northwest Ordinance, Congress passed an Act establishing Agricultural Experiment Stations in connection with the Colleges of Agriculture and it endowed these Stations in the sum of $15,000 annually. The original grants on which rest the State Universities west of the Allegheny Mountains were grants of land and when each territory had bound itself to comply with the conditions imposed by the general Government, the gift became irrevocable. The same was true of the land grant of 1862. But the Act of 1887 gave grants of money to be appropriated by Congress at each regular session and

the stations were placed under the supervision of certain officers at Washington. It was made the duty of these stations to make investigations into the arts and sciences connected with agriculture and to spread among the people by publications and otherwise the results of these investigations and such accumulations of useful knowledge as the stations might be able to gather. At first glance the field of investigation seems to be narrow, but, in reality, it was very wide. It includes research in Agronomy, Animal Husbandry, Dairy Husbandry, Veterinary Surgery, Horticulture, Entomology, Botany, and so much of Physics, Chemistry and Bacteriology as are involved in problems connected with the soil, with plant life and with animal life. But much more is involved in this remarkable Act than appears on the surface. Our forefathers had worked their way slowly to the idea that public money might justly be used for the education of the young, provided they were gathered together in elementary or secondary schools, or in colleges or universities.

But the Act of 1887 declares that public money may justly be used for research. This was an immense stride forward. Our forefathers came slowly to the idea that public money might justly be used for the education of the young provided that they were assembled in schools, colleges, or universities. But the Act of 1887 declares that the results of research in the Stations and the accumulations of useful knowledge pertaining to agriculture may be spread among the people broadcast at public expense and the information is to be given to men and to women and to the young, the middle aged and the old, not collected in schools, colleges, or universities, but at their homes. The knowledge is to be spread by publications, lectures, or by any other proper method. The Federal Government in this Act endowed research and also University Extension. So anxious was the Government to facilitate the spread of information among the people that the publications of these Stations are carried in the mails free of postage. Our forefathers justified the education of the young at public expense on the ground that an intelligent citizenship was necessary for the maintenance of republican institutions. They seem to have feared that an uneducated rabble might rise some day in this country as it did in France to tear to tatters the fabric of Government. Their policy was based on selfishness although the selfishness was not lacking in enlightenment. In the Act of 1887 the Government came much nearer than it had ever done to a policy of altruism in public education. "We must educate," said our fathers, "to protect our institutions." "We must educate," say the men of today, "because it is as much the function of a Government to educate its people as it is its function to rule them and to protect them." "We must educate," say the men of today, "not only because of the preciousness of our institutions but also because of the preciousness of the individual soul." While the Act of 1887 does not include this modern altruistic view as stated above, it comes far closer to it than any other Act of the Federal Government has hitherto come.

The endowment of 1887 was not irrevocable. Therefore, as often as Congress meets in regular session and passes appropriations for the Experi-

ment Stations, it thereby sets its seal to the truth of all the doctrines in the original Act, which was passed not by one Congress in a spasm of exalted virtue, but has practically been ratified by every Congress since 1887.

The states at first accepted the Federal bounty without doing anything themselves. The general Government had been leading faster than they were prepared to follow. But slowly first one and then another began to make appropriations out of state funds for their Experiment Stations until at the present time there is probably not a commonwealth in the Union that does not add out of its treasury to the amount received by its Station from the general Government. Therefore, as often as each Legislature meets it sets the seal of the State, unconsciously perhaps, to the truth of all the doctrines contained in the Act of 1887.

A Missourian may be pardoned for saying that the Act of 1887 was introduced by William H. Hatch, who for many years represented in Congress the First Congressional District of Missouri. The measure is now called unanimously "The Hatch Act."

In 1890 Senator Morrill, the father of the Colleges of Agriculture, introduced into Congress an Act increasing their appropriations in a sum of money which was to grow annually until it became $25,000 a year. This is generally known as the "Second Morrill Act." It was signed by Benjamin Harrison.

Does it seem to be an accident, or more, that all the steps forward of the Federal Government in its leadership of the States in public education were taken under the administrations of great Presidents? Is it an accident or more that none of these measures were passed under the administrations of Martin Van Buren, William Henry Harrison, James K. Polk, Millard Fillmore, Franklin Pierce, James Buchanan, Rutherford B. Hayes, and so on; but they were passed under Washington, Lincoln, Grover Cleveland, and Benjamin Harrison? And some would fain hope that yet another is to be passed under that magnificent man and hero, Theodore Roosevelt. It is a goodly fellowship of Presidents.

Harvard points with pride to her pious founder and so likewise Yale and Princeton and the Hopkins and Tulane and the University of Chicago. Some of these founders, peradventure, were not very pious but the term is still applied to them and probably justly. Pious they have been, certainly, in so far as they have founded institutions of learning. The State Universities west of the Allegheny Mountains can point with pride, as to a pious founder, to the Federal Government. They have been founded by their States and are proud of that fact, but they do not forget that the State was originally guided by the Government of the United States. In a certain sense they can claim as founders Washington, Jefferson, Lincoln, Cleveland, and Benjamin Harrison. These universities may lift up their heads in just pride for their lineage also has been illustrious. They beyond all universities in America ought to be nurseries of civic virtue. In their midst should burn like a vestal flame, unquenched and unquenchable, love of state and love of our common country.

PHYSICS SECTION

A SIMPLE FORM OF MACH'S WAVE APPARATUS.

PROFESSOR E. A. STRONG, MICHIGAN STATE NORMAL COLLEGE.

The simplification of the old form of Mach's Apparatus, a piece often made or imported by schools and colleges, consists in three modifications which only slightly impair the efficiency of the apparatus, while they render it cheaper and more convenient.

Instead of the usual rigid supports, the collapsible parallel bars may be mounted on ordinary laboratory standards by means of clamps. The apparatus may then be rolled up and treated like a map or chart, thus saving space,—a most valuable asset in a laboratory.

In order to release the balls in the two representations of reflected or stationary waves, electro-magnets may well replace the cumbrous lever, worked by the foot, seen in the original piece. Better still, a simple gravity release may be used.

Also the same piece that is used to pull off the longitudinal progressive wave may be used to pull off the transverse progressive wave.

The piece was exhibited and put into action.

Among the many methods employed to show wave forms, the speaker preferred some of the stroboscopic methods, as Quincke's.

THE RELATION OF MATHEMATICS TO PHYSICS IN THE HIGH SCHOOL.

DR. H. M. RANDALL, UNIVERSITY OF MICHIGAN.

At the present time a widespread interest has been aroused in mathematics, and some very radical changes in the methods of teaching it have been suggested. As the subject of physics is involved in the proposed changes, it seems but fitting that this conference, the representative body of physics teachers of this state, should undertake to do its part towards finding a solution for the problems thus called forth. I have been asked "to start the ball rolling," and feel I can do so in no better manner than by stating as briefly as possible, first, what seems to be the prevailing sentiment regarding mathematics teaching; second, the general ideas of the proposed changes. My information upon the subject has been derived largely from articles which have appeared during the last two or three years in various mathematical, scientfic, and educational publications. At the best, then, what follows can be regarded only as a summary of the ideas of the writers of

these articles, a majority of whom, it may be worth while noting, are mathematics teachers.

There is a large class of persons, including in their number engineers, physicists, and chemists, who want their mathematical knowledge to be strictly usable. It is the consensus of opinion among these men that it is not usable to a sufficient degree, and they demand that the mathematics taught them be less formal and more practical, and, moreover, there is a growing tendency to the admission that this position is a sound one, that knowledge, so taught that it can be used, must necessarily be more valuable than when taught otherwise.

Physics teachers as a class, moreover, have a grievance arising from the attitude which pupils assume to all things mathematical in physics. While physical ideas are being developed, a class may be all interest, but when the time comes to express those ideas mathematically, the situation changes. The more conscientious prepare to receive the bitter which always accompanies the sweet, the less conscientious ones, while present in body, are plainly absent in mind. This attitude is indicative of the dislike which the pupil has acquired for mathematics during his training in it, and of his belief in its uselessness. It is a severe criticism of the present method of teaching the subject. If physics teachers have anything to ask of mathematics teachers, it is that they endeavor to change this attitude of the pupil to the reception of mathematical ideas. As one can be interested in those things only which one can understand and do, the above situation seems to demand also less formal and more practical mathematics.

Now as to the general ideas of the proposed changes. Great emphasis has been placed on the value of mathematics as a means of mental discipline. So much so possibly that it has often become the end. Prof. Klein of Göttengen has called attention to the fact that another chief value is this: "To make the conviction grow that correct thought on the foundation of correct premises gives mastery over the external world. To do this, attention must be directed to the external world from the beginning." This is the key to the proposed changes. A quotation from a report "On the Teaching of High School Mathematics," read before the Mathematics Section of the Chicago and Cook County High School Teachers' Association, states the idea very plainly. "In present discussions of the possibility of improving the teaching of mathematics, the vital point seems to be that there should be, first, a concrete problem and then its expression in mathematical language, rather than first instruction in the language and then its application to the expression of problems. By problems we mean some real question in the world of senses, not an example from a book. If this is right, the equation has no right for existence till there is first a truth for it to tell. The more the truth told appears to the pupil as worth telling the better." If the pupil then has had experiences which are capable of being expressed mathematically, use them, if not, give him such experiences. As an illustration of the latter case, a spring balance, when the stretches due to various weights are noted, tells the fact that the stretch is always a certain number of times

larger than the weight, say 5, this truth may be briefly expressed by the equation $s = 5\,w$. Another balance may give $s = 8\,w$. Other balances would yield similar results, and a second important truth appears, *i. e.,* all balances have similar equations. This may be told by $s = c\,w$, a general equation, which can be applied to any balance as soon as c is experimentally determined.

Use is to be made of a pupil's intuition and experience. If his common sense tells him that a certain mathematical idea is true, to compel him to demonstrate it before his logical powers are sufficiently developed to make him feel the need of a proof, is to put him often in a state of confusion, as he can see no reason for proving something which is selfevident. On the other hand, if an experimental test of his ideas shows their correctness, he gains confidence in his judgments. So experimental proof may often be substituted for formal demonstrations, and even the conclusions reached by such demonstrations may well be tested experimentally.

If the pupil's mathematical ideas, wherever possible, are thus derived directly from his experiences, will he not regard the subject as a most practical one? Will he not naturally wonder, when he has acquired ideas by observation, if they may not be mathematically expressed? In short, will he not have that attitude to the reception of mathematical ideas which physics teachers would wish him to have?

To furnish these concrete ideas upon which the mathematical ones are to be built, there will have to be a mathematical laboratory. This laboratory, if one judges from the lists of necessary apparatus, might well be mistaken for a physical laboratory. This means that physics is regarded as the subject best suited to give the needed experience, and that mathematics and physics are to be closely correlated or possibly more. It may mean that neither mathematics nor physics, as such, is to be taught, but in their place a single subject which is the result of thoroughly amalgamating the two. That such a scheme could not possibly succeed if applied under present conditions is evident to no one more clearly than to those who are proposing it. Its present practicability is not the question, but rather, would such a training give the pupil a mathematical and physical knowledge which is usable, and would he be filled with a desire to use it? If this question is answered in the affirmative we come to a most practical question of our subject: To what extent could these ideas be put into operation at the present time? In the first place, teachers with a sufficient knowledge of both mathematics and physics for the successful correlation of the two subjects in the manner indicated are very few in number, and progress must of necessity be slow until such teachers are developed. However, if the present situation be accepted as it is, it is possible to make modest attempts in the direction indicated. Such attempts are being tried at various schools, notably at Lincoln, Neb., the Bradley Polytechnic Institute at Peoria, Ill., and at a number of schools in and about Chicago. The general plan of operation seems to be to have in the first year of high school work a course in elementary science, in which the physical laws with which the pupil comes in daily

contact are explained by aid of experiments. Upon the concrete ideas thus obtained, the algebra and geometry taught together are founded as much as possible. This work is continued during the second year with the introduction of elementary ideas of trigonometry. The results are said to be a greater thoroughness and insight into the subject of algebra and geometry. The pupil comes to the subject of physics proper in the third year with definite, usable ideas in mathematics, which include those of positive and negative quantities, ratio both direct and inverse, together with considerable skill in the manipulation of such equations as are ordinarily found in physics.

AN INDUCTION COIL INTERRUPTER FOR CURRENTS OF HIGH VOLTAGE.

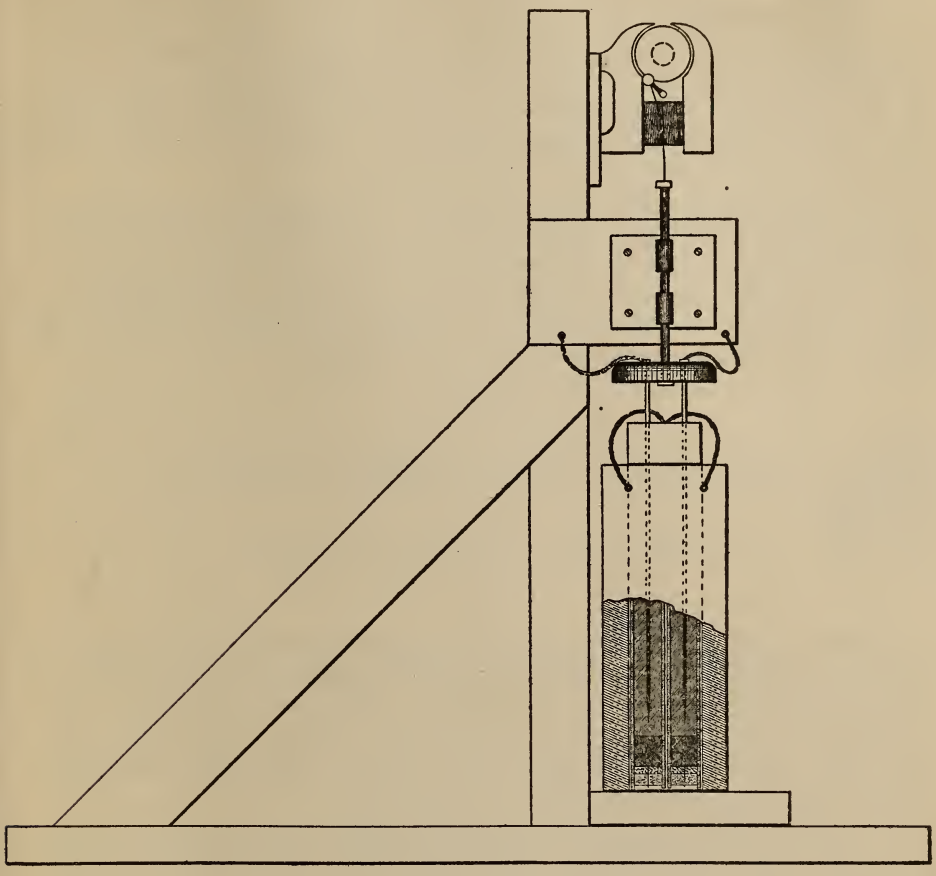
PROFESSOR G. E. MARSH, ADRIAN COLLEGE.

In induction coil work the ordinary interrupters cease to be of service if the potential difference across the break, when no current is flowing in the primary coil, is high enough to maintain an arc between the contacts, namely, about 40 volts. In the case of a coil energized with current derived from a 500 volt circuit, the drop in potential at the break is many times this voltage if the current-strength is of the requisite magnitude.

The apparatus about to be described was devised to permit the operation of an induction coil on a current accompanied by a potential beyond the range of the ordinary interrupters. The principle involved is the following: A mechanically actuated interrupter of the mercury-in-alcohol type, possessing multiple contacts or plungers, electrically connected in series, and having a large and rapid motion of translation. In detail, the interrupter consists of four glass tubes 5-8 inch in diameter and 8 inches long, placed in a square, zinc-lined box, the dimensions of which are such as to hold the tubes securely in position. The unusual length of the non-conducting liquid is to provide a column of oil or alcohol so deep that its inertia is a factor in resisting and preventing the formation of bubbles of vaporized oil at the moment of breaking the circuit, and which are essential to the existence of the arc. The lower end of each tube is closed by a cork and a layer of plaster of paris. Electrical connection is made with the stratum of mercury in each tube by means of a wire carried down through the central space between the tubes, and terminating in a flat spiral resting on the layer of plaster of paris.

Attached to the lower end of a brass rod, constrained to move vertically by means of suitable guides, is a disc of wood, and from this are supported the four plungers. In order that the plungers may be as rigid as possible, and yet free from any undue weight, they are made of copper tubing, ⅛ inch in diameter, the lower ends of which are provided with sharply-pointed copper tips. Electrical connection is made with the plungers through flexible

conducting cords. The zinc lining extends above the tubes, and kerosene oil, which is used in preference to alcohol for obvious reasons, fills not only the tubes but the space about them. The motor has a pinion on the armature shaft which meshes with a second gear on the crank shaft. The gearing is on the farther side of the motor and is not shown in the illustration. In order to simplify the mechanical construction, a piece of spring brass was



used to connect the sleeve carried on the crank with the rod supporting the plungers. This rather novel use of spring brass in lieu of the ordinary connecting rod introduces no especial resistance, and answers satisfactorily.

The breaks occur in series: that is, the mercury of tube No. 1, say, is electrically connected to plunger No. 2, and the mercury of this tube is connected to plunger No. 3, and so on. Thus there are produced simultaneously four arcs, and, in order that they may be started at the same instant, it is clearly necessary that the heighth of the mercury in each tube shall be the same, supposing, of course, that the plungers are of equal length. If one of the plungers fails to emerge from the mercury at the same instant the

others begin to leave the surfaces, the delinquency of the first increases the intensity of the arcs at each of the other three, and by prolonging the dying away of the current lessens the efficacy of the interruption. A condenser is shunted around each of the four places at which arcing takes place.

The motor alone is capable of running at a very high speed, though, with the load resulting from the weight of the moving parts, the number of interruptions is not greater than 250 or 300 per minute. The success with which the interruptions are accomplished is such that it is perfectly possible to join the coil and interrupter in series with a suitable rheostat, and obtain a satisfactory spark-length when the current is taken directly from a trolly line and has strength of 15 amperes. A shunt of comparatively high resistance connected around the coil and interrupter is, however, an addition that improves the performance of the induction coil.

By increasing the number of plungers or the rapidity of operation, or both, the fall of the current can be made as brief as required, and thus adapt the apparatus to the successful interruption of currents of any voltage. In the case of four-plunger interrupter such as described, and making three hundred breaks a minute, the time consumed in the dying away of the current is not greater than one-thirtieth of a second.

NEW USES OF THE MICROMETER SCREW.

PROFESSOR N. F. SMITH, OLIVET COLLEGE.

So many quantitative experiments in physics involve a measurement of length, that accurate methods of measuring this quantity have always claimed a large share of attention. For elementary students the micrometer screw is probably at once the simplest and the most accurate method available. Hence new uses of this instrument are constantly suggesting themselves. The following applications have been found useful:

1. *In the Determination of Young's Modulus by Stretching.*—A wire about four or five meters long is rigidly fastened to a solid wall by a heavy hook at one end. The free end passes over a pulley and carries the load. Near the free end an index of wood or metal is clamped to the wire and projects between the jaws of a micrometer caliper clamped in a rigid support. By this method the elongation of the wire can easily be measured with considerable precision.

2. *In Determining the Coefficient of Linear Expansion of a Metal.*—Many laboratories are supplied with a linear expansion apparatus in which a lever is used to magnify the amount of expansion. Considerable inaccuracy arises from the difficulty of measuring exactly the length of the short arm of the lever. This troublesome measurement may be avoided by

inserting between the end of the bar and the short arm of the lever a thin piece of metal whose thickness is approximately equal to the amount of expansion of the bar. The motion of the long arm of the lever can then be observed and the thickness of the metal measured with the micrometer caliper. A simple proportion then gives the expansion of the bar. The same method is of course applicable to other cases where the lever is used as a magnifying device for measuring a small distance, as in problems on the elasticity of bending, etc.

3. The third experiment to which I shall call attention is one which can be elaborated almost indefinitely according to the advancement and ability of the student. It introduces him to a most fascinating field of experiment to which but little attention is ordinarily given in a laboratory course, viz., the passage of electricity through gases. The particular experiment to be described has for its object the determination of the spark length in air at atmospheric pressure, which requires the same potential difference as a spark of constant length at various lower pressures. For this purpose a receiver, provided with an adjustable spark gap, is connected with the air pump, and the electrodes are set at a distance of two or three centimeters. One of the ordinary terminals of an induction machine is removed, and in its place is mounted a ball on the end of a micrometer screw in such a way that the distance between the two terminals can be readily measured. The terminals of the machine are then connected with the electrodes of the receiver and the air exhausted. The spark gap on the machine is then adjusted till the discharge passes with equal readiness between either pair of terminals. A pressure gauge connected with the receiver gives the degree of exhaustion. A small amount of air is admitted, increasing the pressure, and the adjustments are repeated.

Some uncertainty exists in making the settings because it is difficult to judge when the spark passes with equal readiness by either path. The condition of the electrodes and of the air between them have an important influence. After the discharge has once commenced to travel by a particular path, it appears to adhere to that path in preferance to the other even when the distance is somewhat increased. Nevertheless, by exercising care and taking the mean of several settings for each pressure, a very characteristic curve may be obtained. Since the length of spark is not proportional to the potential difference, the curve does not give directly the relation between electromotive force and pressure as might be desired.

An interesting variation of the experiment consists in keeping the spark length in air fixed at some constant value, such as half a centimeter, and varying the length of the gap in the receiver with each change of pressure until the two gaps are equivalent. A scale graduated directly on the rod of the movable electrode serves to give the spark length in the receiver. In this case the potential difference is kept constant, and we have the relation between spark length and pressure. The same method would serve to compare the dielectric strength of different gases.

THE USE OF THE WIRE MICROMETER IN MEASURING EXPANSION.

H. N. CHUTE, ANN ARBOR, MICH.

In the problem of determining the co-efficient of linear expansion, the chief difficulty encountered is that of measuring accurately the expansion of the rod or tube. The wire micrometer offers a very simple solution of this problem. Instead of a rod, use a tube, supported horizontally on two blocks fastened to a board or clamped firmly to the experimental table. These blocks are placed near the ends of the tube. The tube is held in place by a pin passing vertically through it near one end. This pin projects a few centimeters above the tube. The other end of the tube is kept in place by a staple. The tube is now free to expand in one direction. A second pin is soldered vertically to the tube and near the free end and the length of the tube is taken as the distance between the two pins. The wire micrometer is clamped over the free end of the tube so that the face of the screw can be brought against the outer face of the pin and the reading taken. The head is now given two or more turns backward, and steam passed through the tube till it is thoroughly heated. The micrometer head is then turned till contact is secured as shown by the slipping of the head, and the reading again taken. The difference of these readings gives the expansion. The temperatures are obtained in the usual way.

AN EXPERIMENT IN INTERFERENCE OF LIGHT.

PROFESSOR N. F. SMITH, OLIVET COLLEGE.

A simple interference apparatus has been suggested by Dr. Millikan, of the University of Chicago, which, so far as I am aware, has not been described publicly. Its simplicity renders it suitable to place in the hands of elementary students. Two pieces of plane parallel glass about three centimeters long are mounted in openings near the ends of two straight sticks from forty to fifty centimeters in length. The sticks are hinged together like a pair of tongs and the pieces of glass adjusted to accurate parallelism when the "tongs" are closed. The angle between the plates can be adjusted and the extent of opening measured by a micrometer screw placed near the open end of the "tongs."

When the plates are set at an exceedingly small angle and viewed by monochromatic light, interference fringes parallel to the hinge are distinctly visible.

If w is the width of one fringe, α the angle between the plates, and λ the wave-length, then evidently

$$\alpha = \frac{\frac{1}{2}\lambda}{w}.$$

If δ is the opening of the tongs, and l the distance from hinge to micrometer screw, then we also have

$$\alpha = \frac{\delta}{l}$$

$$\text{Hence } \frac{\delta}{l} = \frac{\frac{1}{2}\lambda}{w}$$

Since all these quantities except λ can be directly measured, we have a method for determining the wave length of light. The method is not one of great accuracy, but it appeals to the student strongly because of its simplicity. If it is found difficult to render the plates accurately parallel, we may make two settings giving fringes of different widths, and then determine the difference in the extent of opening.

THE SLABY ARCO SYSTEM OF WIRELESS TELEGRAPHY.

L. G. HOLBROOK, MICHIGAN AGRICULTURAL COLLEGE.

The three leading systems of wireless telegraphy in use at the present time are the Marconi system, owned by the Wireless Telegraph Company, London; the Braun system, owned by Siemens & Halske, of Berlin; and the Slaby Arco system, owned by the Allegemeine Elektricitäts-Gesellschaft, of Berlin. The principles upon which different systems are based are very much the same. The difference lies in minor points and details of more or less importance in perfecting the system, making it more effective and reliable.

The system devised by Slaby and Arco is the system adopted officially by the German government, and is used by the German navy on all their battleships, cruisers, torpedo boats, naval stations, etc. Also over a hundred stations have been set up on land at various places, making a complete system for military operations.

The apparatus consists of earthed transmitting and receiving antenna and direct coupling at the transmitting and receiving circuits. The sparking circuit is connected direct to the transmitting antenna and the earth. The exact influence of earthing has not as yet been clearly determined, but experiment has shown the desirability of earth connections. It establishes the

nodal points of the pressure oscillations and obviates the possibility of dangerous pressures for the operator.

The transmitting circuit consists of:—

1. Motor current circuit: Source of supply, switch, motor, regulating resistance.

2. Make-and-break current circuit: Source of supply, switch, primary of the inductor, turbine interrupter, Morse key. The primary condenser is in parallel with the interrupter.

3. Inductor high-tension circuit: Secondary winding of induction coil, spark gap, capacity (consisting of Leyden jars), exciting coil.

The receiving circuit consists of:—

1. Coherer current circuit: Coherer, syntonising coil, coherer element, relay windings, hammer and junction. A condenser is in parallel with the syntonising coil and the coherer.

2. Battery current circuit: When the relay armature has closed contact, the parallel coupling of the hammer electro magnet, of the Morse recorder, and of the polarizing cells is made through the battery.

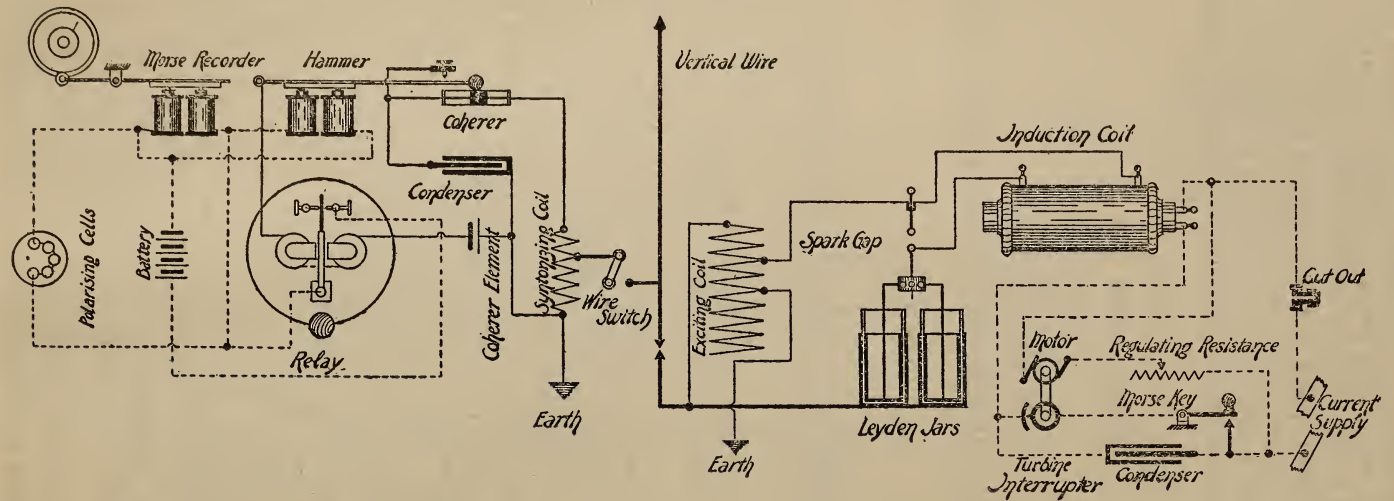
In the transmitting circuit either alternating or direct current is used for the source of supply.

For the make-and-break, the so-called turbine interrupter, designed by the German Electric Company, is found most successful. It contains a metal tube bent at right angles, the lower part dipping in mercury, and its horizontal arm covered with alcohol. The lower part of the tube is in the shape of a turbine wheel, so that when the tube is revolved by means of a small electric motor, the mercury is drawn up the tube and is discharged as a heavy jet from the horizontal arm of the tube. The mercury jet hits upon a metal ring made with a segment and placed concentric to the shaft, and thus makes and breaks the circuit. The mercury bath is connected to one main of the supply and the metal ring to the primary of the induction coil.

This type of interrupter is superior to either the hammer or mercury type of interrupter, which depend upon an electro magnet for their action. These under the most favorable conditions will not give more than forty makes-and-breaks per second. They are not adapted for rapid movement with large currents, and so can not be used for long-distance work. The turbine interrupter also has advantages over the wehnelt type. It is more continuous and more capable of standing rough usage. For ordinary work, however, the wehnelt interrupters are very desirable. They require no motor or condenser, and give from 260 to 2,000 makes-and-breaks per second.

In the receiving circuit the coherer is of special importance. The Marconi coherer is found most reliable. It consists of a glass tube in which is placed nickel and silver filings between two metal conductors about an eighth of an inch apart. The air is withdrawn from the tube, and the tube is sealed. Decoherence is made by means of a hammer electro magnet.

For anything but short distance work, a very sensitive relay is necessary. Extreme care is taken in construction to reduce friction to the least possible



RECEIVING STATION. SENDING STATION.

minimum, and design the parts so as to attain the highest sensibility. The best relays are sensitive to the current of one ordinary dry cell acting through a resistance of 150,000 ohms.

One of the special features of the Slaby-Arco system is the tuning or syntonising of the receiving with the transmitting circuit. It is shown mathematically and confirmed by experiment that the total length of an oscillating wire correspond to half the wave-length of oscillations; each half of the wire or antenna is the fourth of a wave-length. Each wire excited by a sparking circuit has certain defined oscillations to which the electric waves it sends out into space correspond. These waves set up oscillations in the receiving antenna by induction. This receiving wire, from its size and length, is suited to a given kind of oscillation. If this be the same as that of the transmitting wire, it responds much more readily. The more complete the tuning the more complete the action. The tuning is accomplished by means of syntonising coils of wire and condensers. If the tuning is very accurate, multiple telegraphy from the same receiving antenna is possible, each system being tuned to its own transmitting circuit. Slaby was the first to give publicity to this form of multiple telegraphy. In December, 1900, he received two messages simultaneously from one common antenna. The wave-length of the first system was 640 m., distance 9.3 mi.; the second 240 m., distance 2.5 mi. A simultaneous recording of seventy-two words per minute was received.

For long-distance telegraphy Count Arco has devised a portable syntonning coil, by means of which perfect syntonism can be obtained without effecting other relations.

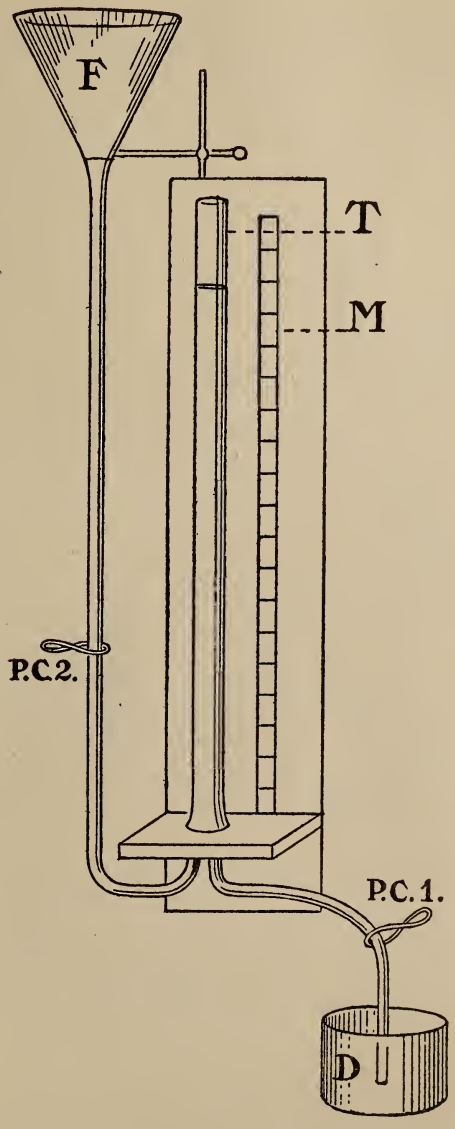
Although tuning will not prevent entirely interference by other systems, it is as yet the principal means of obtaining non-interference in wireless telegraphy.

A DEVICE FOR REGULATING LENGTH OF AIR COLUMN IN A RESONATOR.

J. E. FOX, THREE RIVERS.

The apparatus ordinarily used consists of an assemblage of parts similar to the one in the drawing, the length of air column being varied by raising or lowering the reservoir. I place the water supply stationary, above the tube (t), which is closed at bottom with a double perforated rubber stopper, through which pass two tubes of glass or brass, one of which is connected to funnel (f) with rubber tubing, the other to dish for holding water. Both tubes are closed with pinch-cocks marked p. c. in drawing.

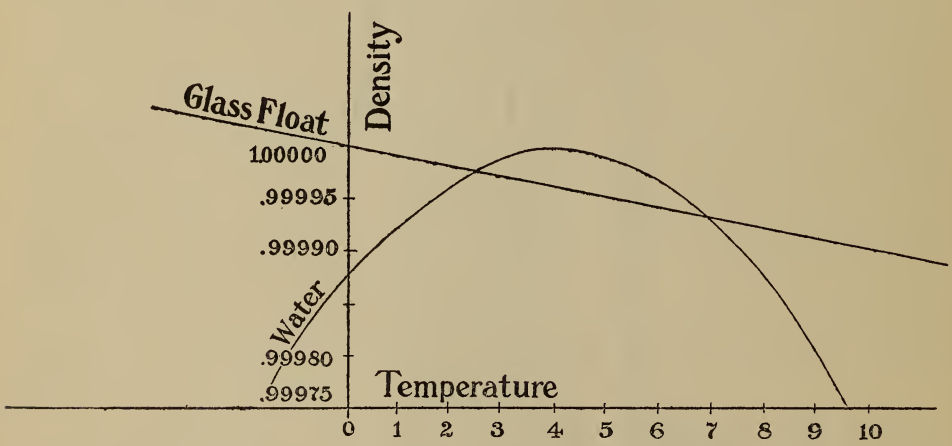
The operator sits in front of apparatus with (p. c. 2) in left hand, and (p. c. 1) in right, and eye in line with the water level. He thus has perfect control of the column through the agency of the pinch-cock. Occasionally the water may be poured from the dish to the funnel.



AN EXPERIMENT TO ILLUSTRATE THE MAXIMUM DENSITY OF WATER.

CHAS. W. BURROWS, DETROIT CENTRAL HIGH SCHOOL.

This experiment was suggested by Thos. Preston ten years ago but only recently has the suggestion been acted upon. The essential part of the experiment is a glass float so adjusted as to be but slightly heavier than water at 0° C. In this illustration today I am using three floats of slightly different densities. The curve of density and temperature tells the story of what happens.



Beginning at 0° C the glass is heavier and sinks but as the water warms the water grows heavier and pushes the float to the surface only to allow it to sink again after the point of maximum density is passed. Owing to the slight difference in density the floats do not rise at the same temperature. The following data are suggestive. The temperature is the temperature of the middle of the water:

Float	Rising		Sinking	
	Top	Bottom	Bottom	Top
Small	0	1	10	12
Medium	1.3	2.3	8.8	10
Large	3	4	6	8

If we try to get the point of maximum density from this table, we find it at about 5° C. This is the result obtained by Depretz in 1840 by means of the water thermometer. The true maximum can be obtained only by a correction due to the expansion of the glass. However, the experiment illustrates very forcibly the fact that there is a point of maximum density.

ENGLISH SECTION

THE VALUE OF LITERARY MODELS.

ROSE M. KAVANA, TEACHER OF ENGLISH IN THE JOSEPH MEDILL HIGH SCHOOL, CHICAGO.

One who undertakes to discourse on the value of literary models as a method of teaching composition has to encounter at least two varieties of objection. He finds that a considerable number of English teachers do not believe in training the student to follow models of any kind. Another class are not opposed to the use of the imitative principle, but they regard with suspicion any attempt to make the work of the high school student literary.

Addison tells us of the "condition of a good man that had one wife who took a dislike to his gray hairs and another to his black, till by their picking out what each of them had an aversion to, they left his head altogether bald and naked." When some of my listeners have picked the literary and others the imitative element out of the method for which I am to speak, my subject, too, may be altogether bald and naked.

A letter which came to me recently regarding the teaching of composition expresses these two objections in the form in which one commonly meets them. "I do not believe," says the writer, "in the use of literary models. I think the method lays so much stress on the mechanical, arbitrary side that instead of developing it would decidedly retard originality. I think it is too far from the actual life interests of the boy and girl, too advanced in literary ideal to be practical in its results. I think that it is of more value to the boys and girls and to the city and the country that they should be able to discuss potatoes, and wheat and threshing machines, and street cars and griddle cakes than it is that they be able to discuss in a superficial or even better fashion the latest or even the best in literature and art."

Let us consider first the objection that the imitative method hampers originality.

It is a commonplace of psychology that we find the imitative and creative impulses closely united in the child. He has a double personality. On the one hand he is slavish in imitating all examples set around him by his elders, and on the other hand he is self-assertive, that is, creative. Nature has joined these two powers together in the individual, in his physical, social and intellectual life. He begins his existence with but few acts of skill, and it is by imitating his elders that he acquires the further acts of skill to be found in his social environment. In the course of his effort to copy these models he finds that he consciously or unconsciously introduces novelties into his imitations. This is the beginning of invention,

for the child sees that he is not entirely dependent upon models. He learns that he can turn out interesting products containing some element at least that is his own peculiar creation. Thus our inventions grow naturally out of our imitations, as variations on the type or model. There is such a thing as imitative invention. We are too much inclined to think of imtiation as merely slavish. The divine creator and the slavish imitator are constantly set in antithesis to each other and represent only the extremes. Between these two is the normal individual, with the sense of his own agency on the one hand, and his subjection to social copy on the other. He is a creator as well as an imitator, for if one has any gift of originality, he cannot copy slavishly. It is only the weak-minded who imitate without introducing modifications. "They are slaves because they cannot be anything else. Remove their bondage to imitation," says Baldwin, "and far from becoming free they would perish." Even the genius must subject himself to this law of social absorption, if his work is to receive the permanent sanction of mankind. He can make socially effective inventions only by making new dispositions of the forms, models, activities, organizations, accumulated by race experience and acquired by him through imitation.

We are too much inclined in our abstract discussion of methods of teaching composition to overestimate the amount of originality with which the ordinary student is endowed, and therefore to put the emphasis on the individual and creative rather than on the social or imitative factor. "Console yourself, dear man and brother," says Lowell, "whatever else you may be sure of, be sure at least of this, that you are dreadfully like other people. Human nature has a much greater genius for sameness than for originality." If then in the average boy or girl the imitative is stronger than the creative impulse, and if it is possible to develop the creative through the imitative, the use of models in the proper way is the most natural and least mechanical and arbitrary of methods. At any rate no one has ever discovered a method for teaching originality directly through precepts. "The only way to be original," says Stevenson, "is to be born so." "It is a piece of good luck, the good gift of the fairy godmother brings to her prime favorites in the cradle." All we can do for an original mind is to set it in motion by some external impulse and then direct it. For both of these purposes example is better than precept, for with an inventive mind imitation becomes emulation, the model becomes a challenge, and the product turned out is not seldom better than the model. A critic says of Chaucer, "We must let him if he will eat the heart out of the literature that preceded him, as we sacrifice the mulberry leaves to the silk worm, because he knows how to convert them into something richer and more lasting."

But with all the good things that may be said of imitation we must not ignore the fact that, like all other things, it may be carried to an extreme, by being made so narrow that no room is left for individuality. There must be a compromise between the two principles. Imitation carried beyond the normal will obscure the light of genius. An invention, on the other hand, that shows mere personal capriciousness and rejects the social restraint

which comes through familiarity with literature, that is, an invention not rooted in tradition, may be a thing of great ingenuity, but is not of social value and will ultimately be rejected and forgotten by society. Creations that contain no traditional elements are likely to be mere freaks. A socially effective invention includes not only the personal but the social factor. "Of abstract originality," says Lowell, "we will not speak till authors are raised by some Deucalion and Pyrrha process; and even then our faith would be small, for writers who have no past are pretty sure of having no future." The average high school class is not, however, composed of literary geniuses, so that the problem of curbing erratic invention is not an embarrassing one with us. With the average person imitation is needed not as a check on individuality but rather as an aid to it, for the child who does not imitate does not grow.

It will be readily seen by those familiar with the psychology of imitation, as set forth in the work of Baldwin and others, that I have thus far in this paper merely applied their views to the restricted field of the teaching of composition.

Let us now consider the other class of objectors, those who think we should not aim to make the high school student literary in his writing. They are not averse to the unconscious imitation of literature which comes from the reading and study of the English classics, for every one admits that the boy who reads much will express himself more fluently and correctly than one who does not. He grows because he unconsciously assimilates literary copy above him, transcends the forms of usage in his own social circle and the commonplace thought of every-day life. The random reading of Scott, Johnson, Goldsmith, Shelley, Emerson and a host of others who "added the stolen sweets of truancy to that of study," did more for their literary development than all the formal rhetoric they ever studied.

It is not about this unconscious absorption of literature that people differ, but about the set, conscious following of literary models. We find in reading the biographies of authors that when the time came for them to think seriously about writing as a profession, many of them turned from their habit of desultory reading to the conscious and avowed imitation of literary masters whom they acknowledge as having moulded their style and thought. This is the step some teachers think should not be taken by the high school, or even the college, student. The method of the science class, namely, experiment, observation and inference, is that of the professional scientist. The method of the drawing class is that of the professional artist, but if in the English class we talk about the methods used by writers in learning their craft we are very often thought to be impractical. There is a timidity about this matter that we do not find in the teaching of other subjects. Some of this prejudice against literary methods is due to a belief in the old dictum, *Poeta nascitur non fit,* more of it to the variety of meanings given to the term, the imitation of literature. We shall need to bring these various meanings before us in discussing the objections to a literary method in teaching composition.

To some the following of models means merely imitating the *style* of various authors. The objection to a system of composition based exclusively on the imitation of style is in my opinion well founded. Individual peculiarities of expression are subtleties beyond the analytical and imitative powers of immature students, especially of those of foreign birth. This kind of imitation is too minute and scrupulous to appeal strongly to their interests, and one who looks in their work for the unique word, or the "titillation of the foaming phrase" will look in vain. These refinements belong to more matured workmanship, and may be profitably sought only by those who have mastered the structural elements of the art. Besides, the finding of something to say is quite as much of a hardship as the mode of saying it, and the mere imitation of style does not help us to discover, select or organize material. To begin with the imitation of style is to invert the natural order.

To other teachers the imitating of literature means asking the student to write on subjects which have been treated in short selections by authors. L. Cope Cornford follows this plan in his book on Composition. He gives, for instance, a selection from Stevenson, entitled, "The House I Live In," and requires the student to write a description of his own home; another selection from Mark Twain, on "Cloud Scenery," and then says, "Let the pupil take an opportunity, as occasion serves, to observe some effect of atmosphere, light and cloud; and let him make as an exact picture in words as he can." This method does not of itself build up in the pupil's mind any well-knit system of rhetorical or constructive principles. It is suggestive and stimulating but lacks pedagogical sequence and unity. It does not give us the units of literary architecture, nor does it make the work on even purely rhetorical principles consecutive.

The writer of the letter quoted at the beginning of the paper expresses a third conception of what is meant by imitating literature. He says he thinks it more important that the pupil should be able to talk and write about practical and commonplace things than that he should discuss the latest or even the best in literature and art. To discuss the latest in literature is not to follow literary models. It is merely to use pieces of literature as material for expository themes. On the other hand, one may write about even such commonplace matters as street cars and threshing machines, in a literary way. Burns's "To a Mouse" is on a commonplace subject but does not lack artistic workmanship. To write about a picture is not to paint a picture. Neither is writing about a piece of literature the same thing as writing in literary form and spirit. Moreover, the commonplace furnishes quite as good material for literature as more remote subjects, though it takes a more skillful hand to give it novelty. We cannot escape being literary by discussing steam engines, nor can we become literary by writing about Emerson. Literary quality depends upon the attitude of the writer and the form his work takes. It is not a question of material.

A fourth kind of imitation to which objection may be justly made, is the following of individual authors. In working out a general plan suited to students of different tastes and aptitudes, one would be at a loss to know

what author or group of authors to select. " 'Tis hard to find a whole age to imitate or what authors to propose for examples," says Sir Thomas Browne. We find from the study of literary history that this imitation of a master is the method most frequently used by writers in learning the technique of their art. Stevenson's testimony on this point is very often quoted: "I have played the sedulous ape to Hazlitt, to Lamb, to Wordsworth, to Sir Thomas Browne, to Defoe, to Hawthorne, to Montaigne, to Baudelaire, and to Obermann. This, like it or not, is the way to learn to write; whether I have profited or not, that is the way. It was so Keats learned, and there was never a finer temperament for literature than Keats; it was so, if we could trace it out, that all men have learned; and that is why a revival of letters is always accompanied or heralded by a cast back to earlier and fresher models. Perhaps I hear some one cry out: 'But that is not the way to be original.' It is not; nor is there a way but to be born so. Nor yet, if you are born original, is there anything in this training that shall clip the wings of your originality. There can be none more original than Montaigne, neither could any be more unlike Cicero; yet no craftsman can fail to see how much the one must have tried in his time to imitate the other. Burns is the very type of a prime force in letters; he was of all men the most imitative. Shakespeare himself, the imperial, proceeds directly from a school. It is only from a school that we can expect to have good writers."

If in our high school classes we attempted to carry out this plan and let each student choose his master, we should meet with a practical difficulty; for we should need to have as many text-books on composition as we had pupils, if they were at all varied in taste and capacity. Each book would be a guide for the imitation of a special author. If, on the other hand, we dispensed with the text-book and allowed the pupil to imitate his chosen author without direction, we should be presupposing more of the literary sense than our pupils in general are possessed of. It is only after they have learned a general plan of imitation that they can follow the individual master with profit. This method belongs, therefore, to a somewhat late stage of literary development.

A fifth kind of imitation we also find frequently in the works of authors. It consists in borrowing a hint here, a phrase there, and weaving them together in a design of the writer's own making. This may be called the mosaic method. "How pleasant it is," says Lowell, "to track poets through the gardens of their predecessors, and find out their likings by a flower snapped off here and there to garnish their own nosegays." The literary tact required to do this kind of work successfully is not to be found in the high school student. He is not able to make a unified design for his mosaic material or to put himself into what he borrows.

All of these five methods enumerated are valuable at some point in the development of a writer, but they are severally too narrow in scope, and not capable of sufficient organization, in laying a foundation in the secondary school for either literary production or appreciation.

We have thus far shown, first, that imitation is the basic principle in

the growth of expression; secondly, that socially effective creation grows out of imitation; thirdly, that when the student has assimilated and transcended the forms and thoughts of his every-day environment, as he should do, he must imitate literature if he is to grow. Contact with all kinds of authors is to expression what contact with the world is to manners. It is as true in composition as in other activities that "Home-keeping lads have ever homely wits." Fourthly, we have also shown that certain kinds of literary imitation are too one-sided or too advanced to serve our purpose as a general basis for the teaching of composition.

It remains to set forth in the brief time remaining a kind of literary imitation that may be made definite without being narrow, that directs without being mechanical, and that looks at literature not from the purely rhetorical but from the psychological and distinctly literary side, in such a way as to reveal to the student through literature the natural workings of his own mind.

To do this it will be helpful to use an analogy drawn from mathematics. Our arithmetical notation consists of the characters 0 to 9. These are variously combined to express all other numbers this side of infinity. The first step in learning arithmetic is to recognize the ten primary numbers, the next is to combine them so as to make them express the larger values. In like manner, in the study of composition we must begin by learning to recognize a number of literary units, not arbitrarily invented, but discovered in our own natural and universal mental processes, and illustrated in literature.

In narration, for instance, we find four species based upon the spontaneous movement of the mind in contemplating a series of events. We can think and tell of a series of happenings in the past—this is retrospective narrative; in the future, which is anticipatory narrative. We can follow two series of events happening in different places at the same time. This is simultaneous narrative. The fourth is forward-moving narrative, in which we start at a given point and follow events forward step by step.

In description, are found the units of place, personal appearance, character, mode of life, mood, etc. Exposition, Argumentation and Persuasion may be similarly analyzed, and illustrations of the units drawn from literature.

The next step is to find combinations of these units in the works of authors, for the combinations found in ordinary conversation are too often determined by the accidental and extraneous, and have, therefore, too little design for more formal purposes. After some familiarity with pieces of literature built up out of these units, the student should, however, be able to make effective combinations for himself. It will be seen that this method is based on literary analysis and synthesis rather than on the mere imitation of the externals of literature. The purpose is to put the pupil in possession of the working units of composition and gradually to free him from bondage to his model as he develops the power to make his own combinations.

In the development of this system of units and their combinations, unity

can be secured by making narration the fundamental form. The first themes written should be purely narrative, the next should combine narration and description, the next narration, description, and exposition, and so on.

In composition the structural and decorative aspects should be kept as distinct as in architecture. The tendency in the past has been to overemphasize the finish of a piece of work and to ignore some of the real problems of its organization. I do not wish to be understood as undervaluing nicety of workmanship in the use of the word, the sentence, figures of speech and the various other rhetorical matters. I am merely urging that the scope of composition be so enlarged that the pupil should be trained to handle literary as well as rhetorical units. We have been too much occupied with rhetoric, and yet innovations in the teaching of composition, like innovations in literary production, must not break completely with the past. The traditional work of the rhetorics on the units of expression and the requisites of style is all valuable. We need to conserve the best that has been done in this field with such modifications in treatment and such change in emphasis as may be necessary. This is our rhetorical heritage, but we can advance in the teaching of composition only when we recognize and add to it our heritage in literary methods. We must analyze the inventions in form and matter which we call literature, and with which the race has enriched itself, to find out the laws by which interest is held and attention economized.

PRESCRIBED AND VOLUNTARY READING OF THE ENGLISH CLASSICS BY PUPILS IN THE SECONDARY SCHOOLS.

LAWRENCE CAMERON HULL, HEAD MASTER OF THE MICHIGAN MILITARY ACADEMY, ORCHARD LAKE, MICH.

The title of my contribution is misleading because of its scope. I really wish to ask one or two questions concerning the method of teaching the prescribed selections from the English classics and to stimulate an inquiry into the results actually accomplished.

We shall all agree that English is taught more conscientiously, more earnestly, more systematically, more effectively, than ever before. But the best teachers of English are most willing to admit that they are still experimenting.

Two questions have forced themselves upon me whenever I have considered the work of an individual teacher of English or the outcome of our English teaching in general. First, does the reading of the prescribed selections from a certain author stimulate the appetite for reading more of his work; and, second, what effort is conscientiously made by the teacher to influence the pupil's style of English speech and composition by the loving study of the style of the masterpiece?

I am not in a position to speak intelligently about the first matter. Are any of us prepared to do this in such a way as to justify a hearing? If not, ought we not to consider the question seriously? If the pupil's study of the best English masterpieces creates no passion for more reading of the same kind, if he finds relief from the tedium of an unwelcome daily task by reading cheap and worthless literature, we ought to know the fact. If he developes the dangerous habit of omnivorous and haphazard reading, that fact ought to be known and to have weight in the adoption of practical methods in the class-room. We can not boast of the results of our teaching until we can show that our pupils are learning to despise and shun the latest ephemeral novel, to cease gorging upon the heterogeneous mixture presented by our newspapers and magazines, to reject that which is simply fashionable, and to hold fast to that which has been proved to be eternally good. If the reading of the prescribed classics does not lead to the habit of voluntary reading of the same kind of literature, then we or our methods are at fault. How many of us set such an example in this important matter that our pupils will be able to imitate us safely? We can not create a passion for the reading of Scott if we do not read within a year any other novel than the one set for the pupil's study. What ought to be to him a source of joy will be only a task because it is clearly such to the teacher. If the teacher of English is only a prosaic, unimaginative Gradgrind, he will kindle poetic fire only in the hearts of children who reluct and revolt against him and discreetly admire the things that they know he dislikes. But there are few teachers who deliberately condemn the author whose works they teach. Most of us see clearly that an affectation of contempt for a classic in self-condemnation. We ought all to see that the surest way in which to create an appetite for the best reading in our pupils is to cultivate such an appetite ourselves and to win them by the contagion of our own enthusiasm.

Let me consider briefly the second question. What efforts are we making to influence vitally the style of our pupil's speech and composition by a thorough, conscientious, and sympathetic study of the style of an author whose works we are reading? I do not refer to a critical hunt for misplaced commas, grammatical solecisms, incongruous metaphors, or any other violations of rules laid down in our grammars or rhetorics. People who echo the cheap criticisms of the literary style of Macaulay, or Ruskin, or De-Quincey only air their own foolish vanity. Let us take it for granted that the pupil who approaches one of these masterpieces, whether of prose or of poetry, has a sound training in English grammar and that throughout his secondary school course he is receiving regular instruction in what has commonly been called rhetoric. But let us also assume the reliability of the judgment shown by the generations that have deemed a literary masterpiece worthy of immortality. The vocabulary of English speech grows constantly. Words and phrases acquire new meanings and lose old ones. But it is safe to say that any man who lovingly studies and deliberately imitates Shakespeare, Milton, Dryden, Addison, Byron, Macaulay, Carlyle,

Lowell, or the King James's Version of the English Bible will develop an effective English style just as certainly as Franklin or Ruskin did by conscious or unconscious imitation. May we not say that the end of all the English work of our pupils, the finest flower of all our English training is the acquisition of an effective style? Of course it is true that in a sense the style is the man or woman. It is also true that if one has things to say and is properly trained he can say these things in such a way as to command a hearing. But we are not "trustees of civilization" if we teach our pupils that a crude and raw expression is consistent with noble and worthy thought. The best thought is impossible without worthy expression.

I fear that the colleges have led the schools somewhat astray in this important matter. The amount of reading prescribed for careful study is not small. The questions set for examination for admission to the colleges show that the examiners are concerned almost entirely with matters of interpretation. The questions deal with history, mythology, psychology, and dramatic criticism; but hardly a question is ever asked that concerns itself with the effectiveness of the author's style, and in marking the candidate's paper the weary examiner is compelled to use the blue pencil solely upon misspelled words, misplaced marks of punctuation, and grammatical errors.

The teacher in the secondary school judges of the college ideal by the character of the examination. This influence is felt only indirectly in this favored region where entrance by certificate has so largely banished the older method of college admission. But the indirect influence of the older system is still great even in schools that send graduates only to our state university or to other institutions that have been converted to the more excellent way. College entrance examination boards have a more vital influence upon the English teaching in our schools than any other agency. Yet in twenty sets of college entrance examination papers recently examined by me, including those of Harvard, Yale, Princeton, Williams, Amherst, Mount Holyoke, Bryn Mawr, Wellesley, Pennsylvania, Michigan, Chicago, Wisconsin, Illinois, Minnesota, Leland Stanford and the College Entrance Examination Board, which speaks for most of the collegiate institutions along the Atlantic seaboard, I have found hardly a question directed toward the discovery or the appreciation of a single beauty of style. Of course it is true that thought precedes expression. I am not pleading for the ignoring of the author's thought for the purpose of emphasizing the need of attention to the form of expression. No masterpiece is worthy of immortality that is not ennobled by the dignity and strength of its thought. But the really great authors have been able to vivify the trivial and the commonplace by the vigor and charm and simplicity of their own style. Can we read The Cotter's Saturday Night, The Deserted Village, Evangeline, or The Vicar of Wakefield without learning this lesson? Of course we all know this. But how many of us make it a part of our daily life? How many professional teachers of English linger lovingly over the beauties of a classical author and try to communicate the contagion of their own joy

to their pupils? How many pupils begin to show a dawning appreciation of style while in the secondary school? How many college students can confess to an appetite for a delicately phrased sentence or a well-rounded paragraph?

It is true with this matter, as it is with that spiritual process known as conversion, that the normal and healthy boy or girl can not locate the exact moment when this sense of joy in the use of words first became consciously recognized. Yet most of us can tell who first stimulated the quick development of the sense. The enthusiasm of some one who loved literature for its own sake, father, mother, teacher, or trusted friend, this is the provoking cause of this wonderful pleasure. And so I am not pleading for methods. Let me rather state my sincere conviction (here as in the other matter) that in the teaching of English the personality of the teacher counts for more than in any other work of our schools. Pupils will not develop a passion for the best reading if the teacher is pleased with commonplace and trivial stuff; pupils will not reverence and love the literary style of a master till they have seen the fires of reverential love blaze upon some altar reared by genuine enthusiasm.

HISTORY SECTION

THE TEACHING OF CIVICS IN THE HIGH SCHOOL.

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We are told that during the Age of Pericles every Athenian citizen was qualified to hold civil office and ably to direct the policies of state. Certainly this cannot be said of American citizenship at the dawning of the twentieth century. Furthermore, a condition exists that suggests the ravages of a fatal disease rapidly working its way to the very vitals of the body politic. It is not necessary to describe here a situation that is so well known to us all. There is enough of political ill in our land today to demand, upon the part of those who are intrusted with the education of the youth, most careful consideration. There is a demand for a better understanding of our political institutions,—their history, their purpose, and their actual working. Amid all the political isms of the day some intelligence should direct the rising generation. With the dangers so evidently before us, some guiding hand should point the way. And when we look behind the screen of laws and constitutions, and behold the trusts and politicians building up a system of bribery that bids fair to become an American institution itself, and realize that in public life the "highway of corruption is the road to success," then, we appreciate the need of a higher moral standard of living,—a more righteous citizenship.

Many men look back upon the history of our country and are proud of her glorious achievements, their hearts respond with swelling pride as they recall the names of her great men, and when her honor is attacked stand ready to die in her behalf. Yet, how many can be found who, knowing of the enemies within her borders that are undermining her very foundations and bringing shame upon her flag, are willing to sacrifice even a small part of their time for her sake? As Josiah Strong has put it, "we are in need of a new patriotism,—one that prompts men, not to die for their country but to live for it, which is as much more heroic as it is difficult." Wherein lies the salvation of our country if it cannot look to its public schools to teach the kind of patriotism that is most needed? It may not be possible for us in our day, to reach the civic perfection of the Age of Pericles, yet our system of education is at fault if it does not strive, so far as it may, toward that much to be desired goal. We are attempting this very thing in all that we teach, but is it not possible through a proper teaching of Civics, to do even more than has yet been accomplished?

The high school holds a unique place in relation to this subject. Comparatively few students who attend college will give attention to it, and little can be done in the lower grades beyond gaining a familiarity with the nomenclature of political science. In the high school we reach the largest number of pupils who have attained an age of experience and appreciation sufficient to take up the subject in a practical manner. It is here that we may expect the largest results. The public high school is supported by the taxpayers, and is in duty bound to make the best possible return for the investment made. The public certainly has the right to expect an annual installment of intelligent, conscientious citizens, fully realizing their obligation to the community in which they live.

Practically all authorities have accepted the demand for a course in Civics in the high school, and by almost universal consent it forms a unit with American history, and is offered in the twelfth grade. A few schools are still giving this subject below the twelfth grade, but are rapidly coming to realize that it can, under the circumstances, be little more than a review of the manual of government, and that the time might better be spent upon some other subject.

Before we can attempt to solve the problem before us, we must consider the varied conditions with which we are surrounded. While the course of study may be uniform, there may be a great difference in the work actually done. The number of pupils in the class, the number of teachers necessary to conduct the work, the location of the school, and the library equipment are all important factors in the character of the work attempted. The student himself must also be taken into account. What are his home influences? What advantages of progressive historical study has he had? What has been his training and experience in the use of a working library? But the most important element is the teacher. Is he specially prepared to teach the subject? Is he also the teacher of American history? Has he several other subjects to handle at the same time and in no way related to Civics?

Is he himself enthusiastic and the kind of citizen that he would make of his pupils? We may classify these conditions approximately by the general terms,—the small school and the large school. The small school presents to us a few students, probably one class in the subject and a small number of works in the library. The student has had little opportunity to develop historical methods of study and he may or may not have become familiar with the forerunners of our political institutions. In all probability the teacher has not specialized in the subject and is called upon to teach several others at the same time. On the other hand, in our largest schools we may find enough students taking the course to demand the entire time of one teacher or at least the teacher of American history, who may have specialized in his subject and can give his whole energy to his work. The school is equipped with a large and choice working library. The student has followed the work in history through the Ancient and European units, and in the work in English history has studied the origin and development of those principles of government and those very political institutions that are our own today. He may have taken a special course in the use of a library until he is prepared to do intensive work and to do it well. These two extremes and probably all intermediate stages are to be found within our state. This makes it impossible to lay down a rule by which all may be guided. Each teacher must meet the conditions bravely, and, with an ideal before him, strive to make the best of them.

The problem that first presents itself to the teacher is how to cover the ground of both American history and Civics in one year, and at the same time to accomplish the purpose and intent of each subject. The student in most instances is prepared to do an advanced grade of work, and the opportunity should not be denied him. Two general plans may be adopted, —a single course combining the two subjects and two separate courses. To combine the two subjects would mean that one would become an adjunct or side issue of the other. The chief difficulty seems to be to find a satisfactory point at which to take up the very important division of local government and municipalities. Objections to the plan are that the continuity and logical development of one or both subjects may be sacrificed, the attention of the student is more or less scattered and little opportunity is offered for intensive methods of study. However, this may be the only feasible policy to pursue for many schools, its success depending almost entirely upon the teacher. To conduct the courses separately is ideal and yet it also has its drawbacks. Then the question arises, how can the ground of either course be covered in one semester? The experience of many is that with the ordinary text-book in American history, beginning with the Age of Discovery, and with methods adapted to the ability of the twelfth grade student, the term will close with the class just beginning the period of the Civil War. The study of American history in this day and for this generation should not stop here. Also, if the course in Civics is studied from the historical standpoint, the student is covering again the Colonial and Revolutionary periods. This is an unnecessary repetition within a year. If five recitations per week are given, three

may be taken by American history and two by Civics. One plan which has been tried with success when four recitations per week are given is as follows: The so-called Colonial Period of American history is taught as a part of English history in the eleventh grade. This is, from the historical point of view, the logical way to treat the English Colonies in America up to the time of their independence, and it certainly gives the student a more truthful view of the history. Then in the twelfth grade the course in American history begins naturally with the constitutional period and reaches satisfactorily the present administration. The course in Civics follows as a history of American political institutions. In this way a thorough review of the Colonial and Revolutionary periods is given as the following topics will show: The New England Township, the Southern County and Parish, The Hundred of Maryland and Delaware, The Mixed Type of the Middle Colonies, Steps Toward Independence, Colonial Central Government, Transition from Colony to State, Steps Toward Union, The American Congress, The Federal Convention, etc. The work of the preceding year and a half is here welded into a whole and applied to the present. This scheme may not appeal to all, but we must consider that what will work successfully in one school may not be at all adapted to another. Once more each of us must meet the conditions with which he finds himself surrounded, and work out his own solution of the problem.

Another question worthy of consideration is in regard to the relative proportion of time to be given to the main divisions of the subject. Most of our text-books give the larger space to National institutions and comparatively little attention is paid to local government and municipalities in particular. We do not expect many of our students to become statesmen or to deal to any great extent with national institutions, but we do expect all of them to become citizens of some city or locality in need of loyal men and women. There is no longer any danger of lessening fidelity to the nation by putting emphasis upon state and city patriotism. If we believe that "in the vitality and strength of our local institutions lies the political stability of our country," can we not best serve the interests of our whole political organization by giving more of our time to a study of the conditions and actual working of the government immediately round about us?

It has been agreed that the relation between history and civics is very close, yet it may be necessary to emphasize the fact that the historical development of our institutions should not be slighted. The student should realize that they are a growth, organic in nature, that they have their roots extending deep down into the past, and are not to be ruthlessly hewn down. He should appreciate the character of that growth, the putting forth of new branches to meet the demands of a progressive civilization, and the process by which the unwritten constitution becomes a visible part of the complex system. He should know the value of public sentiment and should not be led to place too much confidence in the written law or even the constitution itself. As Professor Bourne has said, "it would be truer to teach that we started with a written constitution which shifting political conditions speedily

began to reshape." Thus the saying that "it is the duty of every generation to gather up its inheritance from the past, and thus to serve the present and prepare better things for the future," is particularly applicable to the study of Civics. A better name for the course might be "A History of American Political Institutions."

When taught as a course in history we may claim for Civics practically all of the educational values of that subject. It develops the imagination, the love of truth, and the power of historical thinking and reasoning.. It trains the student, not only in the use of books, but also in original investigation and personal observation of political phenomena. It arouses an active interest in the life of the community in which he lives. And added to these historical values is the intensely practical aim of the subject,—a means of fitting the pupils for the performance of the duties of citizenship and of cultivating in them an enlightened patriotism,—the "new patriotism" so much needed today. As Lincoln Steffens has just said of the great business men of our country, "they simply do not know what patriotism is. They know what treason is in war; it is going over to the enemy, like Benedict Arnold, and fighting in the open against your country. In peace and in secret to seize, not forts, but cities and states, and destroy, not buildings and men, but the fundamental institutions of your country and the saving character of American manhood—that is not treason. That is politics. and politics is business, and business, you know, is business." What a comment upon the existing standard of public morals! The ethical value of Civics when porperly taught, cannot be denied. Here the student recognizes his own relations to society. He is made to understand the obligations that rest upon him as a member of a community, and this knowledge tends to arouse in him a higher standard of moral action. The truth of this may in part be seen in the efforts of our young college men who are today exerting a most wholesome influence in public life. This is not intended for the boys alone but just as much for the girls. This is well illustrated by the yell given by the girls of a co-educational institution before whom Mr. Folk of Missouri appeared to give an address:—

"Joe Folk! Joe Folk!
He's the man,
If we can't vote
Our sweethearts can."

We may fit both boys and girls only indirectly for citizenship, but we may through them lay the foundations for a sound public sentiment, and this after all is the great hope of our political salvation.

The method of teaching Civics, like other problems, depends upon conditions. In general a text-book, when a good one can be found, is in the high school a very desirable help. Several books of merit have recently appeared and more are promised. The difficulty with the ordinary text-book in Civics is that it is written for general sale and is strong only on the national government. The very nature of the subject makes the text-book of minor importance. Our state and local institutions are widely varied and

are constantly changing. Even the national government is gradually expanding its powers, so that we soon realize that the subject is a progressive one and that text-books can hardly keep up the pace. We must teach more than any general text-book can well contain because it is the actual government rather than the theory that we are after. It is pedagogically wrong to teach the youth the theory of government and then send them out into the world to find that the practice is something quite different. The text must be supplemented in various ways in order to put the necessary data into the hands of the students. A choice collection of national public documents may be had for the asking. The state manual with its constitutions, historical sketches, records, maps, reports, pictures, duties of officers, departments, and institutions is a most valuable book. For local government the compiled laws, reports of officers, blank forms used in public business, municipal and department manuals, and the newspapers afford all that can be desired and practically without cost. The student, provided with this source material should, with a fair reference library, be expected to accomplish very satisfactory results.

In regard to the practical value of Civics, we have an opportunity, as in almost no other subject, to bring the student into direct contact with the actual demands of his future life. One of the most valuable aids to the course is a well planned and executed system of student reports. Most of our high schools are located in cities and possibly county seats. If so the student has a perfectly equipped laboratory in which he may work out by original investigation, the theories and principles which he has studied. The character of these reports will be recognized by the following suggestions: A brief report of the actual working of some public office obtained from the laws, the reports, and a personal visit to the office; A report on the method of transacting some actual public business with the blank forms used properly filled out; A report on the passage and execution of some particular law or ordinance with personal observations as to its proper execution, and if not properly executed an opinion as to where the responsibility should be placed; A brief or formal argument for or against some change in the existing forms of government as suggested by the various reform movements. If the student is prepared for the work, longer reports or theses form a very valuable source of training. The subjects should be chosen at the beginning of the semester, work upon them should be continuous, and liberal credit should be given for the result obtained. This work should be original in character and historical, if the source material be obtainable. A few such topics follow: An account of a spring or fall election; The process of taxation in the city or the county; A history of some office or department; Some event in local history; A criminal or civil process at law, etc. Another good scheme is a newspaper clipping note book, in which are kept all clippings bearing upon the work, with comments upon their application to the theory and practice of government. And in this respect the newspapers, which are our public watch dogs, exercise a very wholesome influence. The field is almost unlimited and every teacher who is thoroughly

alive to the possibilities of the subject will find in these reports an inspiration, and will find the students eager and enthusiastic in their work.

In conclusion then we should recognize the need of our country and the opportunity of the high school to serve its best interests. We should strive to improve the existing conditions, the equipment of the school and the preparation of both student and teacher. We should keep before us the responsibility and noble purpose of our work, and with high ideals. employ such methods as may seem best fitted to accomplish the desired results. These methods should aim to bring the student into contact with the actual working of the government in order to emphasize the practical and ethical values of the subject. It should be taught as a separate course wherever it is possible so to arrange it, and placed in the last vear of the high school curriculum. It should prove to the student a means of historical review; it should give him a correct notion of the unity of all history; it should equip him with the weapons of peaceful warfare and inspire him with a desire to serve his city and his country as an independent, intelligent, conscientious citizen.

THE RELATIONS BETWEEN THE TEACHING OF HISTORY AND THE TEACHING OF GOVERNMENT IN SECONDARY SCHOOLS.

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My text will be found in one of the admirable series of lectures on political science by the late Sir John Seeley of the University of Cambridge (England):

> "History without political science has no fruit,
> Political Science without history has no root."

The subject before us is simply the elementary teaching of political science; and these statements in reference to the more advanced subject are equally true in referenc to its more elementary treatment.

I shall take up the two statements in inverse order. And the first point I wish to establish is that the teaching of government, or politics, or political science—whatever it may be called—must be grounded and rooted in history. The attempt has sometimes been made to treat the two as entirely distinct, and to teach government as it exists today merely as a descriptive subject without reference to the past. To do this is to ignore one of the most fundamental facts concerning political institutions, the process of development or evolution, which is no less true of political organization than it is of animal life. Without a knowledge of the historical conditions which explain the origin of institutions and a study of their historical development, it is impossible to understand how our present system came to be, or why many of the existing institutions and laws are as they

are. Without a knowledge of history, it is impossible to realize that this process of development is still going on; and to teach simply the present is to convey an erroneous impression as to the fixity and permanence of the machinery of government. History, too, emphasizes, or should emphasize, the relation between social and industrial conditions and political institutions, and should thus make clear that as the former change the latter may also have to be altered. In all of these ways, then, history is an essential preliminary to adequate work in the treatment of civil government. As Bishop Stubbs has said: "The roots of the present lie deep in the past, and nothing in the past is dead to the man who would learn how the present comes to be."

But, more than this, many of the important topics that are connected with a knowledge of our government and political conditions can be taught in the history course, and some things can be better taught there than in a systematic treatment of present institutions. The course in English history can make clear many features of our political system, such as the safeguards of individual liberty in their development from Magna Charta to the Bill of Rights, the origin and development of judicial courts, and the growth of representative institutions. And the course in American history can explain such matters as the colonial beginnings of local government, the causes which brought about our federal system of government, the general nature of the federal system, the admission of new states, the history of parties and their leading principles; and such topics can be more fully explained in connection with the historical events of the time than in an analytical account of the governmental organization of today.

Moreover, the work in history, or at least a good part of it, should precede the systematic study of civil government in secondary schools. In the elementary schools some merely descriptive instruction in government may be taught in connection with other subjects; but for the more thorough course which secondary schools should offer there are three reasons why the history work should precede. In the first place, the narrative of events which history presents is simpler and easier to understand than an analytical exposition of a political system; and thus lends itself to the earlier stages of instruction. In the second place, the historical facts form much of the material for the analytical discussion: and it is in accordance with scientific method to collect material before attempting to classify and arrange it. To follow the opposite order involves *a priori* assumptions, and inculcates erroneous habits of thought. In the third place, if the teaching of government is to have the largest possible influence in training in the rights and duties of citizenship, it should be taught in the most advanced stage of the school work. If taught in the lower classes, some of the more difficult questions must be omitted or treated in a less satisfactory way than can be done in the upper grades of the same school.

If, then, I have demonstrated the importance of history as a basis for teaching government, it is equally important to emphasize the other part of the text,—that the study of history without some study of political institu-

tion or government is incomplete and misses one of its most important purposes. While in some places civil government has been taught without any basis in history, in others history has been taught without any special work in government, on the ground that all the essential points in the latter can be taught incidentally in connection with the history work; and this latter claim has been implied, if not openly set forth, by some whose statements are likely to carry weight. In my opinion the one view is as mistaken as the other.

The importance of systematic work in government can be shown from general considerations. To be satisfied with the work in history is to assume that the modern scientific method is entirely mistaken, or at least that it is adapted only to the physical and biological studies, and is inapplicable to social and political facts. To state this alternative seems to me sufficient. For I do not think that any one who understands the situation will deny that the same advantages of classification, comparison and analysis apply to the latter field as fully as to the former.

A more specific examination of the particular question will lead to the same conclusion. The study of political history or political institutions by any method as a part of school instruction may be urged on two grounds. In the first place, on the general basis which underlies all education,—for the purpose of securing a knowledge of our environment. In the second place, and in particular, because in a country like our own where the government is based practically on a system of manhood suffrage, and where good government depends on an intelligent and honest exercise of that suffrage, it is essential that the people should understand their rights and duties as voters and citizens and their relations to the government. And if even a small proportion of the citizens are to learn of these things in any other way than through the biased and partisan statements made in the heat of political campaigns they must be placed on the right road in the schools.

That the study of history is an essential part of this necessary training on both grounds I have already indicated. But does this alone give an adequate conception of our political environment, of the rights and duties of citizens, and of their relations to the government? To be sure that my own impression as to what is now covered by a course in history was not mistaken, I have examined some of the most recent text-books in history, and I think I am safe in saying that a course in history still fails to deal with the political environment which is nearest both in time and place, and still fails to acquaint the citizen and voter with many important facts in reference to the government and his relation thereto.

I have already indicated some of the topics connected with the study of government which can be and are considered in a course in history. But in addition to these, there are others of equal importance which are not considered in such a course. Such, for example, are the origin and justification of political societies, the fundamental principles of law and justice, state government—in particular the work of the legislatures and the courts, local government—especially in the cities, the functional activities of govern-

mental officials, the acute political problems of the present, the organization of party machinery and its influence on the working of political institutions. All of these matters are certainly of equal importance with those covered in the course in history; and they include those parts of our political system which most largely affects the daily lives of the citizens, and those which can in turn be most directly controlled by the voters at the polls.

In reference to the one subject of state government, which is entirely ignored in high school courses on history, Woodrow Wilson, now President of Princeton University, has pointed out that:

"All the civil and religious rights of our citizens depend upon state legislation; the education of the people is in the care of the states; with them rests the regulation of the suffrage; they prescribe the rules of marriage, the legal relations of husband and wife, of parent and child; they determine the powers of masters over servants and the whole law of principal and agent, which is so vital a matter in business transactions; they regulate partnership, debt and credit, and insurance; they constitute all corporations, both private and municipal, except such as fulfill the financial or other specific functions of the federal government; they control the possession, distribution, and use of property, the exercise of trades, and all contract relations; and they formulate and administer all criminal law, except only that which concerns crimes against the United States, on the high seas, or against the law of nations."

Not only are such subjects as I have mentioned omitted in the present treatment of history, but it does not seem possible to consider them adequately and to give a satisfactory idea of our present political system by any historical method. History necessarily looks towards the past and surveys a succession of events. A satisfactory treatment of government must look primarily at present conditions and describe a rather complicated mechanism of political organization. The two things are closely inter-related; and I have tried to show how the study of government requires a knowledge of history; but nevertheless the two are distinct, and each can be more easily understood and a knowledge of their mutual interplay can be more easily gained if they are studied as separate subjects.

One serious difficulty in teaching civil government incidentally in a course in history in this country is presented in the character of our government. Doubtless one reason why our text-books and courses in history fail even to mention state and local government after the Revolution, is that it would complicate and confuse the account of national history to combine with it the internal political history of forty-five different states and systems of local government,—for in spite of certain large tendencies in common there are many wide variations between the different states. While, if such a history were prepared, it would overburden the young students with information about other states, which will not directly concern them in the exercise of their political privileges. But by separating the work in government from that in history, it is possible to deal in the government course both with the national government as a systematised whole, and also with the government of the particular state of immediate concern to each particular

school; and to do this in a way that will give some definite notion of each, and of the relations of one to the other.

I shall not attempt to discuss in detail the outline of his course in Government, which Mr Davis has so well described. The essential points of his plan I can endorse, since they are in accordance with what I have said. He bases his course on a thorough foundation of history; but at the same time has recognized that the study of government must be treated somewhat apart from the narrative history, and by the analytical rather than the narrative method; and he has emphasized, what can only be emphasized by such a method, the importance of state and local government. On minor details, as to the precise division of labor between the history course and the government course, there is room for some difference of opinion; and the final conclusion on these points must rest largely on the experience of secondary school teachers.

On one other point I may add a few words,—on the importance of adequate and special training on the part of teachers for work in civil government. Until recently, it must be confessed, our colleges and universities have not offered opportunities for special training in this field; and those now teaching must equip themselves, by studying not merely school textbooks on government, but also more advanced works on political science, current literature on present politics, and the constitutions, statutes and other original sources on political institutions and their working. Those still receiving their preliminary training have now larger opportunities for special training in this field than formerly. And there can be no doubt that the same advantages which result from specialized training in other branches of educational work are to be secured also in this particular subject.

MATHEMATICAL SECTION

MATHEMATICS IN THE HIGH SCHOOL COURSE.*

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I enter a discussion of this feature of a High School Course with some hesitation, for I appreciate, partially at least, the many factors which must be considered in outlining such a course of study. I realize that the first requisite is a comprehensive view of the whole situation, and having obtained that, one must concentrate his attention on a specific detail of the view, without losing sight of the whole. This, I take it, must be a general attitude of the true teacher.

*This paper is a discussion of the preliminary report on a High School Course, presented by the Commission of the State Teachers' Association at the meeting in December, 1903.

Much has been said and written in recent years on the scope and purpose of secondary schools, especially public high schools. A part of this discussion has focused on the idea as to whether the course of study is to be arranged on the basis that the high school is to be the "finishing" school of the majority of those attending, or whether the school is to be considered as merely preparatory to something higher. I have no desire to reopen the discussion, and will allow the Committee of Ten to formulate my position, in which I think you will all, in the main, agree: "The Committee of Ten unanimously agree with the Conferences. Ninety-eight teachers, intimately concerned either with the actual work of American secondary schools, or with the results of that work as they appear in students who come to college, unanimously declare that every subject which is taught at all in a secondary school should be taught in the same way and to the same extent to every pupil so long as he pursues it, no matter what the probable destination of the pupil may be, or at what point his education is to cease. Thus, for all pupils who study Latin, or history, or algebra, for example, the allotment of time and the method of instruction should be the same year by year. Not that all the pupils should pursue every subject for the same number of years; but so long as they do pursue it, they should all be treated alike. It has been a very general custom in American high schools and academies to make up separate courses of study for pupils of supposed different destinations, the proportion of the several studies in the different courses being various. The principles laid down by the conferences will, if logically carried out, make a great simplification in secondary school programmes. It will lead to each subject being treated by the school in the same way by the year for all pupils, and this, whether the individual pupil be required to choose between courses which run through several years, or be allowed some choice among subjects year by year."

In making a course of study like this, I presume that, after settling what specific part the school is to take in the development of the pupils, the next step should be to determine what studies would best accomplish such development. Here, again, I have no desire to present at this time the claims of mathematics as well adapted for this or that discipline. The Committee of Ffteen on Elementary Studies place the study of mathematics side by side with language study, claiming for it a place second only in importance to that of language. The programme of every secondary school in the land furnishes evidence of the high place of importance given to mathematics. The allotment of time, I take it, is a very important matter of administrative detail, one which presents many difficulties, which requires a clear comprehension of the comparative claims of many subjects, and which must often be modified, more or less, by local conditions. With a half-year of algebra in the grades, together, I presume, with more or less experimental geometry in connection with drawing and otherwise, an allotment of fifteen year-hours for algebra and geometry is not far from a fair and equitable one.

I am not sure as to the significance of the words "course of study"; whether it means a course which should be more or less closely adhered to,

or whether it means a course which should serve as a "norm" or basis upon which to build a specific course. From conversation and correspondence with some teachers, I have inferred that the former was intended, for some have indicated their approval of the plan on the ground that, if it were generally adopted, the problem of arranging the studies of pupils moving from one city to another would be greatly simplified. If the latter idea is that of the Commission, it would be easier to discuss; for I could then substitute the word "mathematics" for algebra and geometry, and leave the distribution to the individual school. At any rate, as the distribution of algebra and geometry is to be discussed later, I shall adopt this course.

In the development of our educational system we passed through an epoch when more advanced mathematics were scarcely known in our schools, so that the course in arithmetic was expected to include all that the pupil would ever know of mathematics. With the usual conservatism of educational practices, these methods continued when the more advanced subjects were introduced. It soon became evident that there was, then, no sound reason for the retention of a considerable part of the arithmetic course, and educators charged with making model schedules of work, proposed abandoning a part of it. Foremost among those who advocated this, was the Conference on Mathematics, who reported to the Committee of Ten as follows: "The Conference recommends that the course in arithmetic be at the same time abridged and enriched; abridged by omitting entirely those subjects which perplex and exhaust the pupil without affording any really valuable mental discipline, and enriched by a greater number of exercises in simple calculations and in the solution of concrete problems." As a consequence of this, or better said, simultaneously with this, arithmetic was relegated to the grades in many schools, some persons believing that it can and ought to be finished in the first six grades, others advocating its continuance through eight grades. It may be here added that this does not include so-called "commercial" arithmetic, which is given in connection with commercial courses.

In spite of this, there seems to be a tendency to keep a distinct place for arithmetic in the high school course. In order to ascertain the sentiment of school men on this subject, Professor Lyman and I sent a circular containing this inquiry to school men of the state, mostly principals and superintendents: "Should arithmetic be taught in the high school as a part of mathematics?" The weight of the replies answers the question in the affirmative. Of the forty-one replies received to date, *five* answered decidedly *no; six* answered *yes,* as an elective, and *twenty-five* answered *yes,* without apparent qualification.

How much of this is due to natural conservatism and persistence of educational traditions, or how much to the feeling that the work is not and cannot be satisfactorily done in the grades, it is difficult to determine. I wish I were wise enough to suggest the right course. Sometimes, when I have been annoyed by having the fine point of a beautiful problem in analytic geometry misshapen and blunted by the inability or slowness of a pupil to

add or divide two common fractions, I feel like vigorously advocating arithmetic in the high school. My present feeling on the subject may be expressed somewhat as follows: If the work in arithmetic were done as might reasonably be expected in the grades, if a proper review of arithmetic were opportunely made and emphasized in connection with algebra and geometry, thus enlivening and enriching all three subjects, and if sufficient time were given to do this, then the high school course might omit a formal place for arithmetic. I have in mind a course in mathematics, while others may be thinking of courses in arithmetic, algebra, or geometry.

Most of our engineering schools, and some of the medical schools, which have not set the standard of admission as high as a bachelor's degree, require plane trigonometry for admission. Some schools are doing this work, and it appears on the surface that there should be a place where this could be inserted. It is important enough to receive consideration at the hand of the Commission.

I have been all too long coming to the specific report of the Commission. The course is built on the unit plan, five hours per week for a year in mathematics counting as a unit. It is supposed that a half-year of algebra has been done in the grades, presumably in the eighth. In the ninth grade is placed a year of algebra, five hours per week; in the tenth, a year of geometry, five hours per week; in the eleventh grade no allotment is given to mathematics, but in the twelfth grade is a half year of algebra followed by a half-year of geometry five hours per week during the year. As stated before, I shall not discuss the distribution of subjects feature of the course.

An important defect in the course centres around the gap in the eleventh grade. This appears to me an application of unsound pedagogical principles, which will necessarily impair the results. I consider that the Commission should make a strenuous attempt to remedy this defect, for a discontinuity of twenty-seven months in the study of algebra and a discontinuity of twenty-one months in the study of geometry are imperfections which need only to be mentioned to be seen.

If one turns to the Report of the Committee of the N. E. A. on College Entrance Requirements, he finds suggestions for the arrangement of the course in mathematics from the seventh to the twelfth grades, inclusive, as follows:

Seventh Grade—Concrete geometry and introductory algebra...4 periods
Eighth Grade—Introductory demonstrative geometry and algebra.4 periods
Ninth and Tenth Grades—Algebra and plane geometry.....4 periods
Eleventh Grade—Solid geometry and plane trigonometry.....4 periods
Twelfth Grade—Advanced algebra and reviews.....4 periods

The course under discussion has many of the features of this suggestion. Plane trigonometry is taken out of the eleventh grade, advanced algebra out of the twelfth grade, the solid geometry of eleventh grade is pushed forward to the twelfth grade, leaving the eleventh entirely open, and one hour or period per week is added in each year of the high school course. In this

way, the required subjects are obtained, but the continuity of the other programme is destroyed.

I suppose it devolves upon me to say something in the way of suggestions of a better course, a difficult and delicate matter. I have said that I considered the allotment of time a fair one, and by that I abide. Fifteen year-hours, or if you grant an additional one for reviewing arithmetic, sixteen year-hours will serve as a basis of reckoning. The easiest way of distributing this is four hours per week throughout the four years. The administrator here says that it cannot be administered. Not on the five-hour unit basis truly, but is this the only way possible?

Professor Lyman and I also asked the question, "Should mathematics be taught continuously during the four years?" The answers to this question were about equally divided between the affirmative and the negative. Many of those answering in the affirmative included arithmetic in the course in mathematics. I inferred from explanatory remarks that a number of those answering in the negative did so under the impression that five hours per week for the entire four years was intended. I think most of us would agree with the latter under this supposition. Some Michigan schools follow at present the plan of omitting mathematics from one year of the high school, but I know that in some cases this has proved unsatisfactory. In others algebra and geometry are omitted in two semesters not consecutive, arithmetic being given either as an elective or required study in one of them.

As a compromise with the five-hour unit basis, I would suggest the following:

	Grade	IX	X	XI	XII
	Hours	5	5	3	3
or		5	4	3	3

This puts two years on the five-hour basis, and two years on the half unit basis. Such a course is, and can be administered, as is evidenced by the twenty or more public high schools of Greater New York.

I believe that the Commission has undertaken a good work, and it is in appreciation of this that I have given the matter some attention. I wish their report to be a credit to the educational sentiment of Michigan. As it now stands, I feel that it contains little or nothing, as far as the course in mathematics is concerned, which will be suggestive or helpful to any high school in the state.

SOME GENERALIZATIONS FROM THE ELEMENTARY GEOMETRY BY MEANS OF CENTRAL PROJECTION.

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In the study of advanced geometry, it is found that, by the introduction of certain new or more general ideas, the theorems of the plane geometry as ordinarily developed are but special cases of more general theorems. We readily understand the value of any point of view or method of treatment by which generalized theorems may be obtained, and especially if they can be obtained out of the special theorems themselves. One such method is found in the Projective Geometry. In the following paper, I propose to develop enough of this subject to make a few generalizations of some of the most elementary theorems; and also call attention to a few of the ideas which are of great importance in the modern geometry and which can be readily brought forward in this connection. We shall confine ourselves to relations between plane figures, although we shall find it necessary to make use of certain simple properties of the geometry of three dimensions.

Some of the general characteristics of the relations to be considered by us here are familiar enough to us from our common experience with shadows on the walls obtained by holding some object before a lamp or other source of light, and are readily obtained by comparing the figure held up with the resulting shadow. Of course, this is only a rough approximation, but it will give a very good idea of the character of the relations which we are to consider.

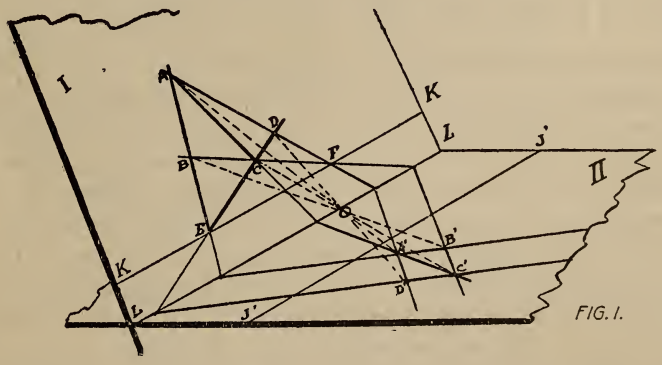


FIG. I.

For the purpose of mathematical study, we reduce to ideal conditions as follows: Consider that two planes are given, one of which is called the *original plane* and the other the *plane of images.* The correspondence between the points of the two planes is such that if pairs of corresponding points be taken, the straight lines joining every such pair always passes

through a certain fixed point not in either of the planes, just as the point in the shadow and the point on the original object, in case before cited, lie on a line through the source of light. In this case the image is said to be obtained from the original object by Central Projection, and the fixed point common to all the lines joining corresponding points is called the Center of Projection. As you may readily see by examining the preceding figure.

From this it follows that only one point on the plane of images corresponds to a point on the original plane and conversely. Also if a series of points on one plane lie in a straight line, the corresponding points of the other plane also lie on a straight line, which is the intersection of the plane of images with the plane through the center of projection and the line in the original plane. Further, if a point describes a curve in the one plane, the corresponding point will describe a curve in the other; this curve is the intersection of the second plane with the conical surface generated by the straight line through the center of projection, O, and the moving point. Then, to a secant to a curve will correspond a secant to its image, and to a tangent to any curve will correspond a tangent to its image.

If we examine our figure more closely, we find that straight lines through a point project into straight lines through a point. Calling I the original plane, we notice that there seems to be an exception when the common point of intersection lies on K K, where K K is the intersection of the plane through the center of projection parallel to the plane II. In this case the lines become parallel, as is indicated in the figure, taking E as the point of intersection, A B E and D C E become A′ B′ and D′ C′ respectively. In this case we say that the point E is projected into a point of II, which is at an infinite distance. In a similar way the points of I at an infinite distance are projected into J′ J′. This we can restate as follows: *All lines of I which pass through the same point on K K are projected into a set of parallel lines on II; and any set of parallel lines of I projects into a set of lines of II which intersect J′ J′ in the same point.* It is evident that every point of L L projects into itself.

Let us now consider the figure made up of the four points A B C D of I, and the straight lines A B, B C, C D, D A passing through them. These form a general quadrilateral. We will now prove the following property:

By a proper choice of the center of projection and image plane, any given quadrilateral can be projected into a parallelogram; and inversely any given parallelogram projects into a non-special quadrilateral, in general.

Let A B C D of plane I be the quadrilateral, and E and F the points of intersection of the opposite sides. Now choose as image plane II, one parallel to the line E F and for center of projection O, any point in the plane through E F parallel to II. We see immediately that projection of the quadrulateral is a parallelogram, and the first part of our statement is proved.

For the second part of our statement we may begin with II as the original plane. Then choosing O as entirely arbitrary, we find that at least one pair of the parallel lines project into non-parallel lines, while in general the projections of both pairs will be non-parallel.

Before turning to the generalization of theorems, we must introduce a few definitions and the fundamental property of Projective Geometry.

Definitions:

1°. If a set of points lies on a straight line, they are said to form a range of points on that line.

2°. If a set of lines all pass through the same point, they are said to form a pencil of rays through that point as center.

3°. The anharmonic, or double, ratio of a range of four points A B C D is

$$\frac{AC}{BC} : \frac{AD}{BD}$$

and is represented by (A B C D).

In this expression we must take into consideration the directions or signs of the segments, remembering that the segment lettered A B, for example, may be considered as described by a point moving from A to B; and therefore that A B = —B A. This leads us directly to the result, that if A B C are any three points of a straight line, then A B + B C = A C, whether B lies within the segment A C or not.

4°. When (A B C D) = —1, the four points are said to be harmonically related or the four points are said to divide the line harmonically.

We will now prove the fundamental property of Central Projection, namely:

The anharmonic ratio of any range of four points is unchanged by projection, i. e.,

$$(A\,B\,C\,D) = (A'\,B'\,C'\,D')$$

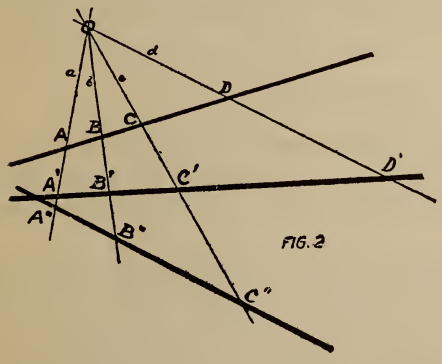


FIG. 2

Call a, b, c, d the lengths of the rays from O to A, B, C, D respectively, and designate the angle between a and b by $(a\,b)$, including sign as in the rectilinear segments above.

Considering the triangles O A C and O B C, we have

$$A\,C : B\,C = \tfrac{1}{2}\,a\,c\,\sin(a\,c) : \tfrac{1}{2}\,b\,c\,\sin(b\,c) = a\,\sin a\,c : b\,\sin(b\,c).$$

Similarly from the triangles O A D and O B D.

$$A\,D : B\,D = \tfrac{1}{2}\,a\,d\,\sin(a\,d) : \tfrac{1}{2}\,b\,d\,\sin(b\,d) = a\,\sin(a\,d) : b\,\sin(b\,d),$$

whence

$$(A\,B\,C\,D) = \frac{\sin(a\,c)}{\sin(b\,c)} : \frac{\sin(a\,d)}{\sin(b\,d)}$$

By the same method we find the same expression for (A' B' C' D'), and therefore

$$(A\,B\,C\,D) = (A'\,B'\,C'\,D').$$

It seems that possibly an exception might occur when the straight line on which we project is parallel to one of the rays. It is readily shown that the relation is still true under these circumstances, as follows:

Take the case where the straight line is parallel to d, then D″ is at an infinite distance.

If we consider the ratio A D : B D, it can be written A B + B D : B D = 1 + A B : B D. When D is at an infinite distance this ratio becomes unity. Therefore

$$(A'' B'' C'' D'') = A'' C'' : B'' C''$$

By considering the triangles O A″ C″ and O B″ C″, we have

$$A'' B'' : b'' = sin\ (a\ b) : sin\ (O\ A''\ B'') \text{ and}$$
$$B'' C'' : b'' = sin\ (b\ c) : sin\ (O\ B''\ C'')$$

From the Figure 2, we see that $sin\ (O\ A''\ B'') = sin\ (a\ d)$ and $sin\ (O\ B''\ C'') = sin\ (b\ d)$. By substituting these values we have the result

$$(A'' B'' C'' D'') = \frac{sin\ (a\ c)}{sin\ (b\ c)} : \frac{sin\ (a\ d)}{sin\ (b\ d)} = (A\ B\ C\ D),$$

as before.

We can consider the double-ratio $\frac{sin\ (a\ c)}{sin\ (b\ c)} : \frac{sin\ (a\ d)}{sin\ (b\ d)}$ as a double-ratio belonging to the pencil of four rays, and represent it by $(a\ b\ c\ d)$. Then in a manner similar to the above we can prove that it is unchanged by projection.

In Figure 2, we then have

$$(A\ B\ C\ D) = (a\ b\ c\ d), \text{ or}$$

The anharmonic ratio of a range of four points equals the anharmonic ratio of any pencil of four rays passing through them; and, the anharmonic ratio of a pencil of four rays equals the anharmonic ratio of any range of four points which lie on them.

It is well to call attention at this place to the reciprocal relation between the point and the straight line, which has appeared in our discussion, and tc which we shall recur several times in our later development, particularly from the point of view that either may be readily considered as the fundamental space element. The point is the space element ordinarily used in the development of the elementary geometry. This idea of considering the space element as being other than a point has been one of very great importance in the modern development of geometrical investigation.

We will now call attention to a few common reciprocal forms of statement, i. e., those in which the word point is replaced by the word line and the word line by the word point, with only such other changes as may be necessary to make the form of statement correspond.

Points on a straight line, or range of points.

A straight line is the join of two points, or

A straight line is determined by two points.

A curve is a locus described by a moving point.

Straight lines through a point or pencil of rays.

A point is the intersection (join) of two straight lines, or

A point is determined by two straight lines (not parallel).

A curve is the envelope of a moving straight line.

A triangle is a self-reciprocal figure, that is, it may be considered as determined by three points or by three straight lines.

From these considerations we see that the relations between the anharmonic ratios of ranges and pencils stated above are reciprocal to each other. These examples will perhaps suffice to make the idea of the existence of a reciprocal relation in plane geometry seem plausible at least.

My first step in generalization will be to derive a theorem for a general quadrilateral from one for the parallelogram.

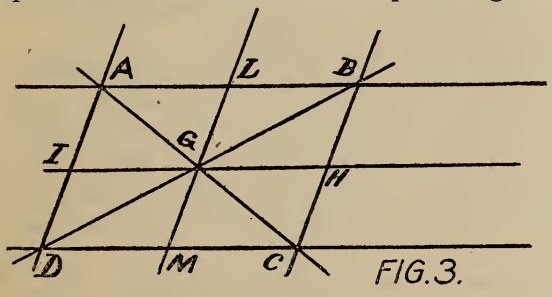


FIG. 3.

Consider the parallelogram A B C D. Through G, the intersection of its diagonals, draw G H and G L parallel to the sides A B and A D respectively. Then H and I bisect the segments B C and A D respectively. Call F the point at an infinite distance on A D, L M and B C. Recalling a result of our previous discussion, we have

$(A\,D\,I\,F) = -1$ since

$$\frac{AI}{DI} \cdot \frac{AF}{DF} = \frac{AI}{DI} = -1;$$

and a similar result for each of the other three sides of the parallelogram.

Since any quadrilateral can be projected into a parallelogram, this result must be true for any quadrilateral whatever. For if we project so that the pencils through F and E each becomes a set of parallel lines, we have the case of the parallelogram just discussed. Therefore in the quadrilateral A B C D,

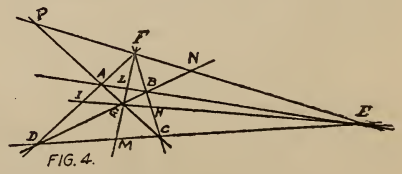


FIG. 4.

$$(A\,D\,I\,F) = -1 = (L\,M\,G\,F) = (C\,B\,H\,F) = (A\,B\,E\,L)$$

Also since the pencil of four rays at E is harmonic,

$$(B\,D\,G\,N) = (A\,C\,G\,P) = -1.$$

We may now state the first part of our result in the following form:

If a line be drawn from the intersection of two opposite sides of a quadrilateral to the intersection of the diagonals, either of the two remaining sides is divided harmonically by its intersection with this line, its intersection with the fourth side and the two vertices on it.

Also, for the second part,

If a line be drawn from the intersection of two opposite sides to the intersection of the diagonals, it is divided harmonically by these two points and its intersections with the remaining pair of opposite sides.

If we call the six intersections of the sides of the quadrilateral (as a four-sided figure) the vertices, and those vertices which do not lie on the same side, *opposite vertices,* as A and C, B and D, E and F respectively, and the lines through two opposite vertices by the name diagonals, as A C, B D and E F, the second part can be restated as follows:

Any diagonal is divided harmonically by the two vertices on it and its intersections with the other two diagonals.

We could easily find further harmonic properties, particularly of pencils, as of those with centers at E, F, G, but we will turn to a result which does not involve lengths but which is purely descriptive in its nature.

From the parallelogram, we know that L H, A C and I M are parallel; then in the quadrilateral we must have the result *that L H, A C and I M must all pass through a same point P on E F or all be parallel to it,* and a similar result for the three other lines I L, D B and M H, obtained in a similar way.

We have thus found two theorems for the general quadrilateral, one containing lengths, the other entirely descriptive, out of two very elementary properties of a parallelogram.

Now take Figure 4, omit the lines F G and E G and the points H, I, L, M determined by them, and construct a new figure in which lines take the places of points and points those of lines in the preceding. We obtain Figure 5, which is called the reciprocal figure of Figure 4; a, b, c, d, e, f are six lines joining four fundamental points of the four-point, and g corresponds to G of Figure 4.

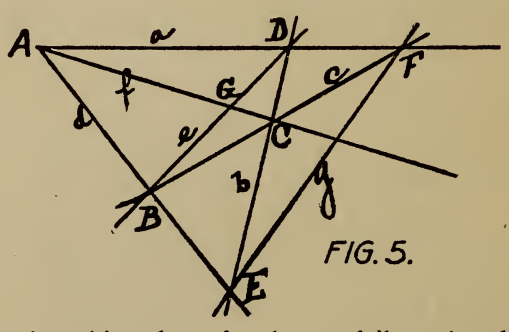


FIG. 5.

We can immediately state new theorems for this configuration by taking those for the quadrilateral and interchanging the words line and point, and defining opposite sides in a way entirely analogous to that for opposite vertices in the preceding.

The following theorem is obtained from that for the quadrilateral of Figure 4 by this method. It can be easily proved by methods already used for the harmonic division of a diagonal.

The pencil of four rays formed by two opposite sides and the lines joining their point of intersection to the two intersections of the remaining pairs of opposite sides is harmonic.

If we letter the intersections in Figure 5, as indicated, we notice that we have a self-reciprocal figure made up of seven lines and seven points, where corresponding lines and points have the same letter.

We will now turn to some further considerations of a similar kind connected with a circle instead of with a rectilinear figure.

Take any four points A, B, C, D on a circle and join them to any two-fifth points P and P′, also on the circle. We know from the properties of the circle that the angle between the pair of rays joining any two points to P is equal or supplementary to the angle between the two rays joining the same points to P′. In either case, we know that the anharmonic ratio is the same for the two pencils. Now project on a second plane from any point. The resulting figure gives a conic section instead of a circle, and two pencils of four rays with their centers on the conic section and the rays intersecting in pairs, on the conic section, one ray of every pair from each pencil. This suggests the following theorem:

If any four fixed points of a conic section be joined to any fifth point on that conic section by straight lines, the anharmonic ratio of the pencil of four rays is constant.

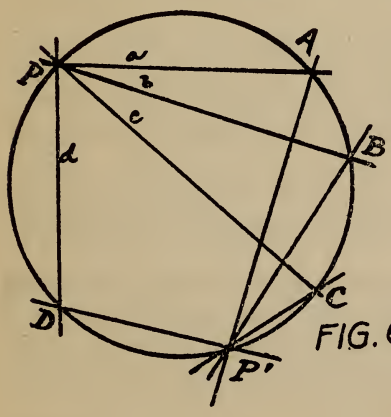


FIG. 6.

This can also be stated as follows:

If in two pencils (each having an infinite number of rays) corresponding rays are determined as those which intersect on a fixed conic section through the two centers of the pencils, then the anharmonic ratios of any two pencils of four corresponding rays are equal.

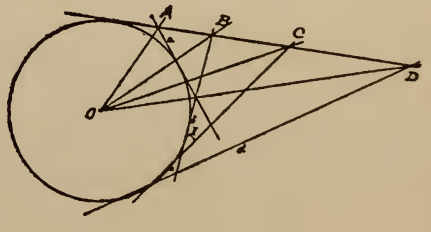
The proof of this could be obtained by using the reverse process of that stated above, beginning with the conic section and making use of the fact that any conic section can be laid upon some cone of revolution.

Turning now to the reciprocal theorem to that previously stated for the circle, using the circle again as basis, we have

If any four fixed tangents to a circle are cut by any fifth tangent, the anharmonic ratio of the four points of intersection is constant.

We will now prove this:

Join the O, the center of the circle to A, B, C, D, the points of intersection of the four tangents with the fifth. We will now prove that the angle between any pair of rays as O B and O C takes a certain value or its supplementary value, and is therefore otherwise independent of the position of the tangent A B C D.



Designating the angle between the

tangents b and c as indicated in the figure by I, we have the following equations:

$$\angle 1 + 2\ \angle BCO + 2\ \angle CBO = 360°, \quad \angle BOC + \angle BCO + \angle CBO = 180°$$
$$\therefore\ 2\ \angle BOC = \angle 1 \quad \text{or} \quad \angle BOC = \tfrac{1}{2}\ \angle 1$$

The positions for which $\angle BOC$ would be the supplement of the above are readily seen to lie between parallelism to b and to c.

We see that a similar set of relations is true for all the pairs of lines O A, O B, O C and O D. Then the anharmonic ratio (A B C D) equals the anharmonic ratio of the pencil (O — A B C D), and as this is unchanged by the change of the position of the tangent our theorem is proved.

Now project. The circle becomes a conic section, the tangents become tangents to this conic section. Our theorem becomes the following:

If any four fixed tangents to a conic section be drawn, the anhormonic ratio of the four points of intersection with any fifth tangent to that conic section is constant.

Or again in somewhat different form:

If in two ranges (each having an infinite number of points), the corresponding points are determined by the fact that the straight line joining them is always tangent to the same conic section tangent to the two given straight lines, then the anharmonic ratios of any two ranges of corresponding four points is constant.

These two theorems suggest their converses, both of which are true but neither of them can be proved without further developments. However, I shall state both of them.

If two pencils of rays mutually correspond so that the anharmonic ratio of any pencil of four rays of one equals the anharmonic ratio of the pencil of four corresponding rays of the other, then the corresponding rays of the two pencils intersect on a conic section which passes through the centers of the two pencils.

And its reciprocal is:

If in two ranges of points, the points mutually correspond so that the anharmonic ratio of any set of four points of one equals the anharmonic ratio of the four corresponding points of the other, the lines joining the corresponding points will touch a conic section which is tangent to the two straight lines of the two ranges.

GERMAN SECTION

THE REPORT OF THE COMMITTEE OF THE GERMAN SECTION OF THE SCHOOLMASTERS' CLUB ON A UNIFORM HIGH SCHOOL COURSE IN GERMAN

The report of the Committee cannot enter upon a discussion of the difficult and perplexing question of the various methods of instruction to be followed in the study of German in the High Schools. This question is so intimately connected with the various grades and kinds of preparation of our teachers of German that no one method can for the present be dogmatically urged. Naturally the American teacher of German will at present be limited to such method or methods as his preparation, training and experience will permit. It is, however, the conviction of the Committee that the spoken language be used as far as possible in the class room and that this be more especially aimed at with students who take four years of German in the High School. The ideal of enabling the student eventually to read German literature in German without translating should be ever before the teacher. The Committee has therefore restricted itself in its recommendations to the amount and character of the work to be done in German each year in the High School. In order to give more specific help and guidance to the teachers of German in this State the Committee has thought it wise to indicate in this report the best grammars, readers, composition books and editions of texts to be used in the High Schools. In regard to the choice of texts the Committee was guided by the principle that only standard modern authors of approved literary excellence should be read, authors who are generally acknowledged by the German people as the soundest interpreters of German life and ideals. Modern German literature is so rich in novelistic, dramatic, historical and lyrical productions of a high order that even for the more elementary classes good literary selections may be found well suited to the age and preparation of High School students. If this principle be strictly observed, the instruction of German will gain enormously in dignity and interest and will greatly extend the range of knowledge and the culture of the student.

FIRST YEAR.

1. Thorough drill in German pronunciation and reading, to be continued through the whole course, whether it extend over two, three or four years.

2. A careful study of the elements of German Grammar—as presented in the First Part of Thomas's Grammar (Holt & Co., New York), pp. 1-175, or in the first thirty-five lessons of Joynes-Meissner's Grammar (Heath & Co., Boston). Keller's First Year in German (American Book Co., New York), Vos's Essentials of German (Holt & Co.), or Spanhoofd's Elementary German (Heath & Co.), practically cover the same ground.

3. Frequent translations of simple English sentences into German to fix the grammatical principles under consideration.

4. The reading of about 100 pages of well graded texts in a reader. The reader chosen should contain interesting selections, written in good modern German, and dealing, as far as possible, with typical phases of German life and literature. A reader like "Glück Auf" (Ginn & Co.), would in extent and character well answer this purpose. Guerber's Märchen und Erzählungen (Heath & Co.) might be substituted.

5. Easy German conversation and composition based upon the selections read.

SUGGESTIONS.—It is very desirable that German script be taught at the beginning of the year and used throughout the whole course. It is advisable that work in reading be introduced early, perhaps after the first six weeks of grammatical instruction.

SECOND YEAR.

1. A thorough review of the elements of German Grammar studied in the first year.

2. Composition. Translation from English into German. For this purpose Harris's (Heath & Co.), Wesselhoeft's (Heath & Co.), or Bernhardt's (Ginn & Co.) German Compositions may be used.

3. The reading of about 200-250 pages of standard literature in the form of short stories, dramas and lyrics. The literature might be selected from the following list:

Storm: "Immensee." Ginn & Co., Holt & Co., Heath & Co., George Wahr, Ann Arbor, Allyn & Bacon, Boston.
Heyse: "L'Arrabbiata." Heath & Co., Holt & Co., George Wahr.
Heyse: "Das Mädchen von Treppi." Holt & Co.
Storm: "Geschichten aus der Tonne." Ginn & Co.
Auerbach: "Brigitta." Ginn & Co.
Seidel: "Leiberecht Hühnchen." Heath & Co., American Book Co.
Zschokke: "Der Zerbrochene Krug." American Book Co., Holt & Co.
Keller: "Legenden." Heath & Co.
Baumbach: "Waldnovellen." Heath & Co.
Fulda: "Unter Vier Augen." Holt & Co.
Benedix: "Der Prozess." Holt & Co.
Wildenbruch: "Der Letzte." Heath & Co.
Rosegger: "Die Waldheimat." Ginn & Co.
A few lyrical selections from: "Deutsche Gedichte." Edited by Hermann Müller, Ginn & Co., or from Hatfield's edition of "German Lyrics and Ballads," Heath & Co., or from Dillard's "Aus dem deutschen Dichterwald," American Book Co.

A good selection would be: "Immensee," "L'Arrabbiata," "Leberecht Hühnchen," Keller's "Legenden," Baumbach's "Waldnovellen," "Unter Vier Augen," "Der Prozess," and a few lyrics.

Some High Schools which provide for only two years of German have

been in the habit of reading a classic drama during the second semester of the second year in order to give to the students some suggestion of the meaning of German classic literature. The practice, though laudable, is in many cases of doubtful pedagogical value, as the student at that stage has hardly attained sufficient knowledge of the language to read with intelligent appreciation a German classic. However, the progress of classes varies, and many teachers stoutly assert that the experiment has been successful. It is the opinion of the Committee that if a classic be read at the end of a two years' course, the most suitable selection is Wilhelm Tell or Minna von Barnhelm.

4. Conversation and composition on the works read.

THIRD YEAR.

1. A review of the elements of German Grammar and a careful study of German Syntax as presented in Von Jagemann's German Syntax (Holt & Co.), or in the Second Part of Thomas's or Joynes-Meissner's Grammars.

2. German Composition. Translation from English into German (Von Jagemann's or Poll's Composition, Holt & Co.), and paraphrases, abstracts or essays on the matter read.

3. The reading of about 400-450 pages of moderately difficult prose and poetry. The works might be selected from the following list:

Dramas.

Schiller: "Wilhelm Tell" (Holt & Co., The Macmillan Co., New York, Heath & Co., and Oxford University Press); "Jungfrau v. Orleans" (Holt & Co., Heath & Co., Macmillan).
Lessing: "Minna v. Barnhelm" (Macmillan, Holt & Co., Heath & Co.).
Freytag: "Die Journalisten" (Holt & Co., George Wahr).
Moser: "Der Bibliothekar" (American Book Co.).

Historical Prose.

Hoffmann: "Historische Erzählungen" (Heath & Co.).
Freytag: "Karl der Grosse" (Holt & Co.); "Doktor Luther" (Ginn & Co.); "Aus dem Staate Friedrichs des Grossen" (Heath & Co.); "Aus dem Jahrhundert des Grossen Krieges" (Heath & Co.).

Novelistic Prose.

Eichendorff: "Aus dem Leben eines Taugenichts" (Heath & Co.).
Ebner-Eschenbach: "Freiherren von Gemperlein" (Heath & Co.).
Fouqué: "Undine" (Holt & Co., American Book Co.).
Freytag: Abbreviated edition of "Soll und Haben" (Ginn & Co.); "Der Rittmeister von Alt-Rosen (Heath & Co.).
Hauff: "Lichtenstein" (Heath & Co.).
Riehl: "Der Fluch der Schönheit" (Heath & Co.).
Rosegger: "Die Schriften des Waldschulmeisters" (Ginn & Co.).
Wildenbruch: "Das edle Blut" (Heath & Co., American Book Co.).

Lyrics and Epics.

A few selections from the lyric poetry of Goethe, Schiller, Heine and Uhland, etc. Hatfield's "German Lyrics and Ballads" (Heath & Co.).
Scheffel: "Der Trompeter von Säkkingen" (Heath & Co.).
Schiller: "Das Lied von der Glocke" (Heath & Co.).

General literary interpretation should be aimed at.

4. Conversation and Composition on the works read.

FOURTH YEAR.

1. Grammar and Syntax reviewed. (Von Jagemann's German Syntax).

2. Composition. Translation from English into German (Von Jagemann or Poll's Composition), and German abstracts and free German essays on the works read.

3. The reading of about 500 pages of standard German literature with aim at general literary interpretation. The lives of several of the great German poets should be read. The following biographies might be used for this purpose:

Lessing: Rolleston. Great Writers Series, London.
Schiller: Nevinson. Great Writers Series.
Goethe: Sime. Great Writers Series.
Heine: Sharp. Great Writers Series.
Uhland: Hewett. Introduction to Hewett's edition of Uhland's Poems. (Macmillan & Co.).

The works read might be selected from the following list:

Dramas.

Goethe: "Egmont" (Ginn & Co., Holt & Co., Macmillan); "Iphigenie" (Macmilian, Heath & Co.).
Schiller: "Jungfrau v. Orleans" (Holt & Co., Macmillan, Heath & Co.), [if not read in the third year]; "Maria Stuart" (Macmillan, Scott, Foreman & Co., Heath & Co.).
Lessing: "Minna v. Barnhelm" (Macmillan, Holt & Co., Heath & Co.) [if not read in the third year]; "Emilia Galotti" (Ginn & Co., Heath & Co.).
Heinrich v. Kleist: "Der Prinz v. Homburg" (Ginn & Co.).
Grillparzer: "Sappho" (Ginn & Co.); "Der Traum ein Leben" (Heath & Co.).
Fulda: "Der Talisman" (Heath & Co.).

Novelistic Prose.

Freytag: "Die Verlorene Handschrift" (Macmillan).
Goethe: "Sesenheim" (Heath & Co.).
Heine: Prose Selections (Macmillan, Clarendon Press).
Keller: "Dietegen" (Ginn & Co.); "Romeo und Julie auf dem Dorfe" (Heath & Co.).
Kleist: "Michael Kohlhaas" (Holt & Co.).

Kleist, Zschokke and Goethe: "Three German Tales" (Holt & Co.).
K. F. Meyer: "Gustav Adolfs Page" (Heath & Co.).
Scheffel: "Ekkehard." Abbreviated edition (Heath & Co.).

Historical Prose.

German Historical Prose: Ranke, Droysen, v. Treitschke, v. Sybel (Holt & Co.).
Schiller: "Der dreissigjährige Krieg" (Holt & Co.).
Von Sybel: "Die Erhebung Europas" (Ginn & Co.).

Epics and Lyrics.

Goethe: "Hermann und Dorothea" (Macmillan, Heath & Co.).
Goethe's Poems (Holt & Co., Heath & Co.).
Heine's Poems (Heath & Co.).
Uhland's Poems (Macmillan & Co.).

4. Conversation and Composition on the works read.

MAX WINKLER, Chairman,
University of Michigan.
HELENE CHRIST,
Grand Rapids High School.
TOBIAS DIEKHOFF,
University of Michigan.
HOWARD EDWARDS,
Michigan Agricultural College.
R. CLYDE FORD,
Michigan Normal College.

SUGGESTIONS FOR A SMALL GERMAN HIGH SCHOOL LIBRARY

A. CLASSICS.

Selected volumes of the works of GOETHE, SCHILLER, LESSING, in Kürschner's "Deutsche National-Literatur," about 75 cents a volume.
GOETHE, volumes 1–21.
SCHILLER, volumes 1–7, 10–12.
LESSING, volumes 1–3, 7, 9, 10, 12.
VON KLEIST, H., volumes 1–4.
HEINE, edited by Elster, 7 volumes, Bibliogr. Institut. $4.00
UHLAND, Poems. The Macmillan Co., 60 cents.

B. BIOGRAPHIES.

The lives of GOETHE, SCHILLER, LESSING, HEINE, in the "Great Writers Series," edited by Professor Eric Robertson. 40 cents a volume.
HERM. GRIMM: "Life and Times of Goethe," translated by S. H. Adams. Little, Brown & Co. $2.50.

Heinemann, K.: "Goethe." Two volumes. Leipzig, E. A. Seemann. $3.00.
Thomas, C.: "Life and Works of Schiller." Holt & Co. $1.50.
Sime: "Lessing." Two volumes. London, 1890. $4.00.

C. HISTORIES OF LITERATURE.

W. Scherer: "History of German Literature." Scribners. $3.00.
Vogt und Koch: "Geschichte der deutschen Literatur." Leipzig. Bibliogr. Inst. $4.00.
K. Francke: "History of German Literature." Holt & Co. $2.50:
John Robertson: "History of German Literature." Putnam. $3.25.

D. DICTIONARIES.

Muret–Sanders: "English-German and German-English Dictionary." Two volumes. School edition. Berlin. Langenscheidt. $4.00.
Fluegel's "English-German and German-English Dictionary." Two volumes. Leipzig. Brockhaus. $4.25.
Heath's "New German Dictionary." $1.20.
H. Paul: "Deutsches Wörterbuch." Halle. Niemeyer. $2.50.
Duden: "Orthographisches Wörterbuch" (large edition). Leipzig. Bibliogr. Institut. 40 cents.
Sanders: "Wörterbuch der Haupt-Schwierigkeiten." Berlin. Langenscheidt. $1.10.
Matthias: "Katechismus des guten Deutsch." Leipzig. Hesse. 50 cents.
F. Kluge: "Etymologisches Wörterbuch." Strassburg. Trübner. $3.00.

E. GRAMMARS.

Thomas: "German Grammar." Holt & Co. $1.12.
Joynes-Meissner: "German Grammar." Heath & Co. $1.12.
Whitney: "German Grammar." Holt & Co. $1.50.
Brandt: "German Grammar." Putnam. $1.25.
Bierwirth: "German Grammar." Holt & Co. $1.25.
Hempl: "Orthography and Phonology." Ginn & Co. $2.00.
Von Jagemann: "German Syntax." Holt & Co. $1.00.
Weise: "Unsere Muttersprache." Leipzig. Trübner. $1.00.

F.—NOVELS.

G. Freytag: "Soll und Haben." Leipzig. Hirzel. $1.75.
V. von Scheffel: "Ekkehard." Stuttgart. Bonn. $1.50.
Spielhagen: "Problematische Naturen." Leipzig. Staackmann. $2.00.
Keller: "Die Leute von Seldwyla." Berlin. Hertz. $2.00. "Züricher Novellen." Berlin. Hertz. $1.00.
Immermann: "Der Oberhof." Stuttgart. Speemann. 25 cents.
C. F. Meyer: "Jürg Jenatsch." Leipzig. Haessel. $1.25. "Novelien." Two volumes; each $1.25. Leipzig. Haessel.
Heyse: "Novellen" (Auswahl für Haus). Berlin. Hertz. $2.50.

STORM: "Immensee." Braunschweig. Westermann. 50 cents. "Aquis Submersus." Westermann. $1.25.
ROSEGGER: "Schriften des Waldschulmeisters." Wien. Hartleben. 90 cents. "Waldheimat." Two volumes. Hartleben. $1.80.

G. HISTORIES OF GERMANY, ETC.

HENDERSON: "History of Germany." Macmillan. $4.00.
HANS MEYER: "Das Deutsche Volkstum." Leipzig. Bibliogr. Inst. $4.00.
ZEHME: "Kulturverhältnisse des deutschen Mittelalters." Leipzig. Freytag u. Tempsky. 50 cents.
PUTZGER: "Historischer Schulatlas." Leipzig. Velhagen u. Klasing. 60 cents.

H. MISCELLANEOUS WORKS.

SCHOENBACH: "Über Lesen und Bildung." Graz. Leuschner. $1.25.
ECKERMANN: "Gespräche mit Goethe." Stuttgart. Cotta. 75 cents.
GOETHE-SCHILLER: "Briefwechsel." Stuttgart. Cotta. 50 cents.
NIBELUNGENLIED (Übersetzt von Simrock). Stuttgart. Cotta. $1.50.
BRUEDER GRIMM: "Märchen." (Large edition). Berlin. Hertz. $1.00.
O. FRICK: "Wegweiser durch die Klassischen Schuldramen." Four volumes. Leipzig. Hofmann. $6.00.

This list of books for a small German High School Library has been prepared by the members of the German Department of the University of Michigan at the request of the German Section of the Schoolmasters' Club of the State of Michigan. The schools are advised, as far as possible, to import the German books of this list directly from Germany, and for their guidance the following German firms are suggested: Bernhard Liebisch, Leipzig, Kurprinzstr. 6; Mayer und Müller, Berlin N. W., Prinz Louis Ferdinandstr. 2; F. A. Brockhaus, Leipzig, Querstr. 16.

It may also be stated that Mr. Gustav Stechert, 9 East 16th St., New York City, is willing to import the German books of this list at the rate of 22 cents for the mark.

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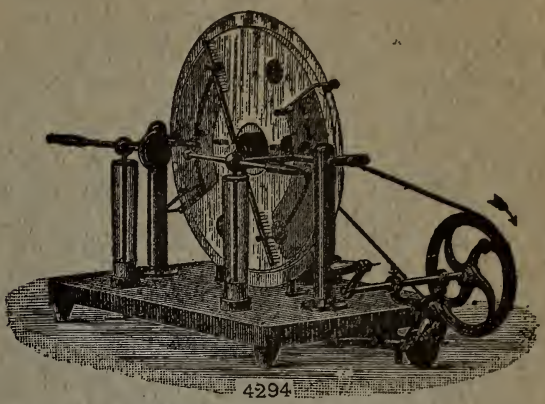

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